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Service Restrictions on Less Essential Industries

LESS essential industries which find difficulty in procuring coal have in many instances found relief by the adoption of central-station service. This practice is fraught with great danger to public utility interests. While it is the purpose of the Fuel Administration to allow public utilities 100 per cent of their coal requirements, the administration has a right to expect that any policy it may adopt toward non-essential industries will not be thwarted in the manner above indicated. Otherwise, it may be necessary for the government to assume control over the distribution of electricity as well.

Our Great Activity in Manufacturing

TOTALS of a very impressive amount of business are being rolled up in the electrical manufacturing industry. They are the direct result of war activity demanding the largest volume of production from every essential manufacturing resource. Evidence of tremendous gross business which is most conspicuous is that furnished by the General Electric Company through the annual report issued this week. Without war munitions, which entered into the figures of 1915 and to a small extent into 1916, the value of electrical and mechanical orders received in 1917 was $246,700,000. By comparison with the orders of the same class received in 1916, this represents a gain of 47.6 per cent, and the increase over the corresponding business in 1915 was 150.8 per cent. In other words, the electrical and mechanical orders received in 1917 were two and one-half times those of 1915. The amount of sales billed was of course substantially smaller. But the 1917 total reached the satisfying level of $196,925,318, representing a gain of 47 per cent over 1916. One qualifying consideration should be kept in mind. That is, that in a period of sharp increase in commodity and labor costs the values mount rapidly. While undoubtedly the increase in quantity of apparatus and supplies is very great, it is not so large as the increase in values in a rising market. In round figures, this one company received orders for $50,000,000 more than the total sales billed. This is roughly one-quarter of the production capacity represented by sales billed in the whole of last year. In general, the figures are a striking testimony to the unparalleled growth presented by the central stations, which have doubled their output since the European war started four years ago in the summer of 1914.

The Enormous Cost of Niagara as a Spectacle

PROGRESSIVE men on both sides of the Niagara frontier are agreed that even before the war a greater diversion of water from the Niagara River was justifiable and that the present emergency merely changes the word justifiable into obligatory. Sir Adam Beck in his testimony at Washington last week presented an official Canadian viewpoint with reference to Niagara, and an American viewpoint is reflected in this week's issue. It is possible, however, to present the situation very clearly, so that any layman may grasp it. In round numbers, the flow of water and the head at Niagara Falls represent 5,000,000 continuous horsepower. Even at the low price of $10 a horsepower year, the spectacle has a potential value of $50,000,000 per annum. Can any nature lover contend that the view is worth any such sum, and would any government be justified in appropriating $50,000,000 yearly to reproduce the attraction? With these self-evident facts in mind, it is difficult to understand why this profligacy continues, especially when there is such urgent need of the power, a willingness to use more water on both sides of the border, and apparently nothing to stop it except the inertia of governmental bodies. Certainly this inertia is extremely costly; it even borders on the criminal and should be overcome at once.

Higher Rates Will Keep Utilities Strong

IMPARTIAL testimony as to the high value of public utility service to the community and to the nation has been forthcoming recently. The national government through various officials, American business as represented by the Chamber of Commerce of the United States, and regulating bodies such as the Public Service Commission of New York, are agreed that it is in the public interest that the utilities be kept in a condition of solvency and efficiency. This tribute is well merited, deserves to be cherished and to be advertised broadly. It is well known that, owing to constant pressure from commissions, the average price obtained for electricity has steadily diminished all through the era of rising prices that preceded the war and even up to the moment when the United States stood on the brink of hostilities. Even now, with conditions more acute, we have still to hear of a single case of ostentatious shutting down to impress upon the public the gravity of the issue. Not only have the utilities been harassed by increasing prices of all material, of labor and of money,

but added to these has been the uncertainty of the coal situation, and now the losses incident to daylight saving. That measures for relief are imperatively needed is beyond question. The government can very properly lend a hand in securing the necessary capital on reasonable terms, especially where extensions are necessary to meet the calls of war. The companies for their part are spontaneously turning to such economies as are feasible, but no permanent relief is possible without an increase in the price of electricity commensurate with the increased costs of serving the public at this time. Commissioner Whitney's statement, we trust, reflects the opinion of most of the public service commissions. At any rate, it is a good omen. The central-station industry faces a financial crisis which calls for immediate relief.

Stimulating Production by Good Lighting

THE advocates of artificial lighting curtailment as a war measure in industrial plants have received very little encouragement from lighting experts of the country. Those who have studied lighting for years realize that as an aid to rapid and efficient production, accuracy of work, prevention of accidents and keeping up the morale of a force of workers lighting is one of the first things to be considered and that the present cost of good artificial lighting either in dollars or in pounds of coal is very small balanced against loss of production efficiency of the workers due to poor light. These matters have been discussed in these columns repeatedly of late, because we conceived it to be an important war duty to aid the speeding up of production in this country by advocating lighting which will help every worker to do his best.

Frederick J. Pearson at the April meeting of the Chicago Section of the Illuminating Engineering Society briefly mentioned some commercial experiments in lighting which are full of interest both commercially and scientifically. That it has been demonstrated by a large mercantile establishment that illumination intensities considerably in excess of the intensities required for easy vision when applied to one department of a store showed increased sales traceable to no other cause than the increase in illumination is full of interest both to merchant and psychologist. It immediately brings up the question whether there is not something more than the mere improvement in visual acuity, however important that may be, to be considered in connection with increases of illumination intensity. The stimulating effect of sunshine and the depressing effect of cloudy weather are well known and in large organizations are directly reflected in the performance records of employees. If brighter lighting stimulates the customer to make purchases, may it not likewise in the office and factory stimulate the worker to more rapid and better work? In so far as it enables him to see better undoubtedly it will help, but beyond that there is an unexplored region of considerable promise, if we are to judge from Mr. Pearson's results supplemented by some well-known facts of human psychology. Just how far it may be worth while to go in the direction of brighter lighting to get this effect is, of course, as yet altogether uncertain, but when the over-all efficiency of a manufacturing establishment is the thing most sought, rather than petty saving in one relatively small item such as artificial lighting, this is a point well worth studying and of immediate commercial importance in these times of forced production.

Standardizing Distribution Construction

IN SMALL plants no very systematic records of construction methods and material are generally to be found. A complete and systematized scheme of construction seems to be, and often is, somewhat burdensome, and there is a constant tendency to leave too much to loose memoranda or to the memory of the foreman. As the distribution system gets more extensive, lack of records leads sooner or later to an indefinite amount of annoyance. Construction departments will find H. E. Wulfing's account of the standardized methods employed by the Commonwealth Edison Company a very useful guide in doing their work in an orderly and efficient manner. To establish a standard is in itself no easy matter, since every place and almost every job has its own individual character.

Perhaps the best scheme is to do the work gradually, settling down upon a few types as the dominant ones in ordinary practice and endeavoring as far as feasible to make others conform to them. If construction gangs are thoroughly saturated with the idea of doing work in a perfectly regular manner according to orderly standards, even if very simple ones, their work will be much facilitated and costs will run lower than they generally do. The system worked out for the Commonwealth Edison Company has, of course, to be elaborate by reason of the immense number of details with which it has to deal. That for the ordinary company is relatively simple, but the same general principles can be carried on throughout with admirable results. Only in a few cases will it be found necessary to adopt in its completeness a scheme based on extensive and diverse work. The plan described by Mr. Wulfing seems to cover effectively about every case which is liable to arise even in the operation of a very large system. Of course, the details of the classification will differ from place to place, but the system of symbols and numbers reduced to terms of local necessities seems to be a very efficient one. Especially to be commended is the plan laid out for standardizing transformer installations, the effect of which is to obviate the necessity for troublesome and expensive changes when the size of transformers is increased to meet the burdens of added load.

Inspection and Care of Transformers

THE distribution transformer is the main stay of lighting and power service. It is likewise the element of distribution which on the whole requires the most careful watching. The paper in our current issue on the systematic inspection and care of the many transformers that come back from the lines for one reason or another is one in which central-station men should have particular interest. The most serious source of trouble with transformers is, of course, in the coils themselves; but there are subsidiary causes of trouble in the bushings, leads, oil and casings which

are often annoying. The first three of these are especially likely to be in evidence with the higher-voltage transformers. Bushings in such cases are rather large and run some considerable risk of breakage, particularly in handling the transformers. The least sign of break or looseness should be remedied by replacement at the earliest possible moment. There is constant danger of electrical leakage from a combination of dirt and oil, especially in the older type of bushings, and when repairs have to be executed the chance should be taken of replacing out-of-date forms with the later ones, which are likely to give less future trouble. To this end a good supply of spare bushings should be kept on hand so that there may be no temptation to adopt makeshifts which are very likely to prove unsatisfactory. In sealing in the new bushings particular care should be taken to see that no cracks permitting leakage are established by hasty replacements.

The transformer leads are likewise common sources of failure. They become soaked with oil, which in the case of rubber-covered leads brings serious damage to the insulation; leads are frequently broken in handling, or cut too short, and when the transformers are removed trouble is imminent. Of course, the main difficulty is with the primary leads, and constant watchfulness is required to see that the leads substituted for the old ones are adequate and are installed with particular care to avoid siphoning the oil, which stranded leads tend considerably to encourage. The oil itself cannot receive too close inspection; sooner or later it accumulates sludge and frequently absorbs moisture. It is a popular error that oil and water do not mix. They do, as every electrical man knows to his sorrow, and the utmost caution is necessary to see that the older oil has not absorbed water, and that the supply used to replace it has not been so stored as to expose it to the same risk. The higher the voltage of the transformer the more consideration must be given to this particular thing. Many a transformer has failed merely as the result of a leaky case. Constant inspection is the only road to safety. Of course, the coils themselves are always to be watched; sometimes a transformer coming in from the lines is clearly and evidently burned out beyond repair. Then, if small and old, it is probably cheaper to scrap it than do anything else with it. If only secondary coils chance to be involved and the transformer is a new one, it may sometimes be rewound at home. But the standard types can most frequently be returned for repair or exchange to the makers to the best advantage. In high-voltage transmission transformers, however, a supply of coils, kept carefully dry, is needed, inasmuch as the windings are usually of a somewhat special character and cannot be obtained without considerable delay.

The Performance of Polyphase Induction Motors

THE polyphase induction motor possesses the peculiar property that the electrical conditions which favor good performance at starting are opposite to those which favor good performance at full-speed running. In order to secure a powerful starting torque, with, say, rated-load current strength taken from the mains, the resistance of the secondary element should be relatively high; whereas, on the contrary, in order to secure good speed regulation and efficiency under normal running conditions, the resistance of the secondary element should be low. If, then, the secondary resistance is to remain unchanged, a compromise value may have to be effected, which limits good performance both during starting and during running. Advantage is sometimes taken, however, of the relatively low frequency of the secondary currents at full speed by making the secondary conductors in the form of straps, so as automatically to offer higher resistance, by edge effect, to the full alternating-current frequency encountered at starting.

The article by Justin Lebovici, beginning on page 866, discusses the relative advantages of different types of induction motors. In the case of squirrel-cage motors a strong and hardy mechanical construction is arrived at; but with no change made in the secondary resistance a compromise between starting and full-speed performance is ordinarily aimed at. If, however, the secondary is phase-wound and connected to external adjustable resistances, through strip rings and brushes, the performance can be made satisfactory during both starting and running, but the machine costs more.

An intermediate type of induction motor has long been used in which resistances carried around within the rotor secondary are short-circuited by means of a hand-operated lever when full speed is reached. The article points out the advantages which pertain to motors of this type when the secondary resistance control is made automatic by means of a centrifugal device. The starting resistances within the rotor are thus cut out of the secondary circuit as soon as the rotor attains an assigned fraction of synchronous speed.

Induction-motor designers very generally employ the phrase "torque expressed in synchronous watts." This expression is well understood, but is most unfortunate from a logical standpoint, since a torque cannot properly be expressed in watts, a torque being a couple of forces, whereas watts are power. Since, however, a torque multiplied by synchronous angular velocity develops watts, the self-contradiction would disappear if the phrase were changed to "torque expressed in watts per synchronous angular velocity."

The Coming Issues

THE current-limiting reactor is rapidly becoming an indispensable adjunct to electric service systems. In view of this fact the ELECTRICAL WORLD will tell in an early issue what considerations should be taken into account in installing it and how it should be maintained to secure the maximum effectiveness. Another article will dwell on the features of recent additions to the Northwest station of the Commonwealth Edison Company, which will shortly be equipped to generate 165,000 kw. with six units. Some of the problems connected with the support of long-span conductors will be discussed in another article contributed to by several prominent Pacific Coast engineers. Factors which must be taken into consideration in selecting, installing and operating motor and control apparatus for industries which are found in nearly every section of the country will also be discussed. A precision method of measuring alternating currents will be explained.

Waste of Power at Niagara

Company Trying to Co-operate in Winning the War, but Continued Unwillingness of Congress to Act Means Insufficiency of Power for Growing Industrial Requirements

AT NIAGARA, the scene of the mighty cataract, there is a power famine. While water falls away over the cliffs great industries, most of which are busy on war work, suffer for lack of sufficient power to operate their plants at the full capacity for which they were designed.

The Niagara Falls Power Company, says Stacy C. Richmond, the president, "is endeavoring in every way to co-operate with the United States War Department to make Niagara power of the greatest possible service toward winning the war."

Congress Is Held to Be to Blame

Yet in his annual report to stockholders Mr. Richmond is forced to explain that the insufficiency of power at Niagara to supply present requirements is due largely, if not wholly, to the continued unwillingness of Congress, since the question of federal control of Niagara diversion was first raised in 1906, to enact permanent provision for the subject and to fix the status and the rights of the companies which had constructed expensive plants pursuant to authority of New York State and had been lawfully operating for many years before their rights were first called into question.

During this time the Niagara company has stood ready upon any reasonable permanent settlement of its rights at least to complete its original undertaking, says Mr. Richmond. This would have substantially doubled the present output of the American plant with little, if any, diversion of water above the amount now in use by it under the existing temporary permit.

The permit for the additional diversion and the authority of the Secretary of War to grant like permits will expire with June 30, 1918, unless meantime Congress shall take further action, as the resolutions of Congress expressly provide that a diversion of any water from the Niagara River after that date in excess of the limitations of the expired Burton law shall be a misdemeanor subject to punishment by heavy penalties.

President Richmond refers to the Secretary of War's order of Dec. 28, 1917, under which the President of the United States requisitioned until further notice the total quantity and output of electric power produced or capable of being produced by the company as well as that delivered to it in the United States from Canada. The order provides that it must be given precedence over any and all orders theretofore placed with the company. Its effect deprives, therefore, some customers of power heretofore delivered them under contracts of long standing and for long terms, increasing the supply to others whose products the federal administration considers more essential to the successful conduct of the war.

Increases in the demands for the indispensable products of Niagara power have been caused by the war. "The federal authorities now have recognized the fact," comments Mr. Richmond, "that the amount of Niagara power available is wholly inadequate for use in the production of sufficient quantities of the articles required to supply the nation's needs and at the same time to supply ordinary business requirements."

Operations in Canada are affected by the attitude of the authorities there. The tenth unit in the plant of the associated Canadian Niagara Power Company was completed and placed in commercial service in January, 1917. The generating installation of that company is now somewhat in excess of 100,000 hp. As showing that more energy could be generated in this plant the company says that its present head works, power house and tunnel are adequate for the installation of another large generating unit.

"The Ontario government, however," says Mr. Richmond, "now claims that the present rights of the Canadian company are limited to the production of 100,000 hp. In this view the company finds itself unable to concur."

Some changes in the Niagara situation are promised by the proposed consolidation of the Niagara Falls Power Company, the Hydraulic Power Company and the subsidiary of the latter company, the Cliff Electrical Distributing Company. This consolidation is authorized in a bill which has been passed by the New York Legislature. Under its terms the rearrangement of securities is subject to the approval of the Public Service Commission.

Fifteen Million Dollars for New Plant

It is estimated that this consolidation will be followed by the expenditure of $15,000,000 for new plant and equipment and that with co-ordination of the properties there will be a total resultant increase in output of 170,000 hp. over the energy that is now generated by the existing properties. Unification of the properties was favored by a representative of the War Department who testified at the hearings before a committee of the Legislature. It is, therefore, as a war measure that the matter has been subjected to investigation and urged before the Legislature with such effect that that body took action.

It is calculated by the Niagara Falls Power Company that for at least the period of the war double the present output of all existing plants could be sold in the districts reached by the power supply.

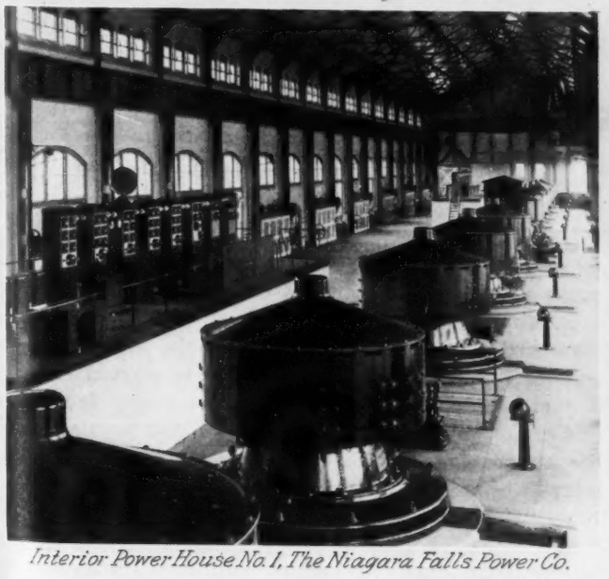
No one will minimize the present urgent demand for power for industries vitally necessary to the war. The industries at Niagara and in the nearby cities reached through transmission lines require power in peace or war time. Grave need of conservation of coal supplies and of the time of labor and the service of transportation point to the logical conclusion that unessential waste should stop. The scenic beauty of Niagara can be preserved while at the same time more water is diverted and conservation made a fact.

Power House of the Canadian Niagara Power Co.

Power House No. 2 of The Niagara Falls Power Co.

Interior Power House, Canadian Niagara Power Co.

Interior Power House No. 2, The Niagara Falls Power Company



Interior Power House No. 1, The Niagara Falls Power Co.

View in Power House No. 2, The Niagara Falls Power Co.

EXTERIOR AND INTERIOR VIEWS OF NIAGARA FALLS HYDROELECTRIC POWER HOUSES

Performance of Polyphase Induction Motors

Choice Should Depend on Nature and Magnitude of Load, Allowable Starting and Running Current, Frequency of Starting and Efficiency of Operation

BY JUSTIN LEBOVICI

Designing Engineer, Triumph Electric Company

TO DETERMINE what type of induction motor is best suited to a particular application it is, of course, necessary to know the nature and magnitude of the load, the allowable starting and running current, the frequency of starting and the relative characteristics of the different types of motors. In what follows the writer will therefore compare some of the commonly used types of polyphase induction motors, taking into consideration different methods of starting them.

SQUIRREL-CAGE MOTORS

I. *Resistance in Series with Primary Winding.*—The torque T in synchronous watts is given by

$$T = M_2 I_2^2 R_2 / S \qquad (1)$$

where M_2 represents the number of phases in the secondary winding, I_2 is the secondary current per phase at full load, R_2 is the resistance per phase, N is the ratio of starting current to full load current, and S is the slip. In starting $S = 1$, and assuming $I_{\text{start}} = NI_2$ and substituting in (1) the starting torque

$$T_1 = M_2 N^2 I_2^2 R_2 \qquad (2)$$

Combining (1) and (2),

$$T_1 = SN^2 T. \qquad (3)$$

Allowing a full-load slip of 4 per cent and a starting current equal to three times full-load current, $T_1 = 0.04 \times 3^2 \times T = 0.36T$, or about one-third normal torque will be developed with three times full-load current taken from the line.

When started with resistance in series with the primary winding, a squirrel-cage motor having 4 per cent slip at full load will take at least five times full-load current from the line in order to develop full-load torque. Evidently this method of starting is inefficient when a torque of from two to three times normal value is needed, but it does not affect the generator regulation so severely as an auto-transformer. Since the resistance is cut out gradually there is no rush of current such as occurs in motors started by means of an auto-transformer when the handle is thrown over from the starting position to the running position.

II. *Auto-Transformers.*—When an auto-transformer is used in starting squirrel-cage motors it reduces the voltage at the motor terminals and the value of the locked current in the same proportion. The primary winding of the auto-transformer will draw less than the motor current from the line, the amount being inversely proportional to the reduction in voltage.

For a normal 50 hp. squirrel-cage motor with a locked current of six or seven times normal, three times full-load line current will be obtained on approximately the 65 per cent tap. The motor current is greater than the line current by the ratio of transformation (3/0.65 = 4.6 times normal current) and for a full-load slip of 4 per cent the starting torque $T_1 = 0.04 \times 4.6^2 \times T = 0.85T$. This exceeds double that in case I for the same line current, so this method is not advisable when two to three times full-load starting torque is needed and the line current limit is three times full-load current (Fig. 1).

For the sizes of motors under consideration (5 hp. to 75 hp.) the scheme of connections shown in Fig. 2 is in common use. The auto-transformer is Y-connected, the motor being a normal star-connected or delta-connected motor. There is no appreciable drop in phase *1* between the terminal *A* and the line L_1, but there are drops in the auto-transformers between the line L_2 and the terminal *B* and between the line L_3 and the terminal *C*. The result is that the voltages *AB*, *BC* and *AC* applied to the motor terminals are unbalanced, which results in a reduction of the starting torque of the motor per ampere taken from the line as shown in Fig. 3.

III. *Star-Delta Connection.*—A delta connection of the primary winding for the running condition and star during the starting period is equivalent to a 58 per cent tap on the auto-transformer and reduces the starting torque and line current to about one-third of full-voltage values. The purpose of the starting device

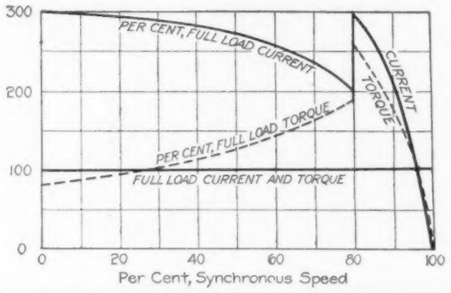


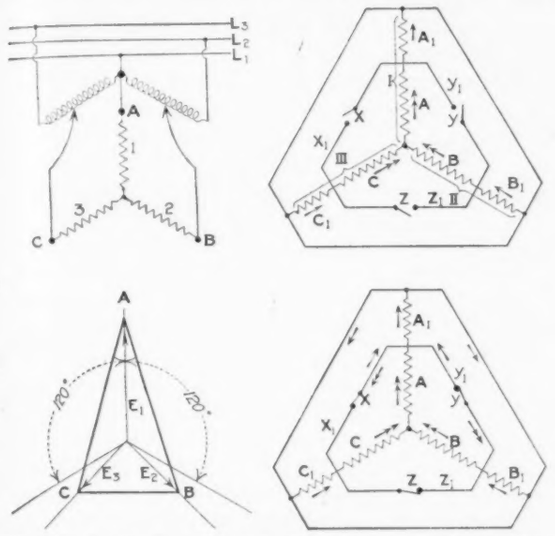
FIG. 1—STARTING CHARACTERISTICS OF SQUIRREL-CAGE MOTOR ON 66 PER CENT TRANSFORMER TAP

Current and torque in per cent of full-load values based on the assumption that a tap is used on the auto-transformer limiting the line current to three times normal. The lever is thrown over to the running position at 80 per cent of full-load speed, which results in a rush of current just before the motor reaches full load speed of four to five times normal current. This does not take into account the drop in voltage in the auto-transformer itself, which may easily reach 15 per cent of the voltage applied at the motor terminals, owing to the intermittent service for which this apparatus is designed.

is to limit the line current to such a value as not to cause fluctuations in voltage which might affect other apparatus on the same circuit.

General Remarks.—The undesirable fluctuation in voltage when a squirrel cage motor is started may be due either to the excessive current taken from the line or its low power factor affecting the regulation of the alternator and the transformer. An auto starter introduces a considerable wattless component of current, owing to the leakage of the auto-transformer and to the high magnetizing current made necessary by the intermittent duty for which auto-transformers are built. Auto-transformers require the attention of a skilled operator to prevent their burning out owing either to maintaining the lever in the starting position

too long or to line disturbances caused by changing over too quickly. If line disturbances are to be avoided, it is impossible to start induction motors by any of the above methods when a starting torque of one and one-half to three times full-load torque is required. To prevent the rotors of the squirrel-cage motors sticking at a subsynchronous speed when starting, it is necessary to make the resistance of the end rings sufficient to give the motor a torque above the friction torque. The starting torque can be improved by using deep slots and bars in the rotor, as this construction will increase the effective resistance at or near stand-still. On the other hand, if the bars are too deep the secondary slot leakage is increased, resulting in a low power-factor motor. Hence advantage can be taken of the deep rotor bar only to a limited extent if the normal load characteristics of the machine are to be maintained.



FIGS. 2, 3, 4 AND 5—USE OF Y-CONNECTED AUTO-TRANSFORMER FOR STARTING AND UNBALANCING OF VOLTAGES PRODUCED; SELF-STARTING MOTOR CONNECTIONS IN STARTING AND RUNNING CONDITIONS

The rotor shown in Figs. 4 and 5 is connected in a single star winding, each phase being split in two parts of unequal resistance. Phase I is divided at A and A_1; phase II into two parts, B and B_1; phase III into parts C and C_1. Variable resistances are obtained by winding A, B and C with a different-size wire of unequal number of turns and wound with a different resistance material from A_1, B_1 and C_1. During the starting period the groups A and A_1, B and B_1, C and C_1 are connected in series as shown in Fig. 4. From the junction point between windings A, A_1, B, B_1, C, C_1, leads X_1, Y_1, Z_1 are brought to one side of the switches X, Y and Z, the other sides of the switches X, Y and Z being connected to a short-circuiting ring. While the motor accelerates from zero speed to about 80 per cent of full-load speed, the switches X, Y and Z are open, but at the latter speed they are automatically closed.

PHASE-WOUND ROTOR

Resistance in the Secondary.—From equation (2) it can be seen that increasing the secondary resistance R_2 raises the starting torque of the motor. As soon as the pull-out torque is reached, however, a further increase in resistance will reduce the starting torque, because I_2 drops faster than R_2 increases. Starting wound-rotor induction motors with resistance in the secondary is efficient and desirable as it is possible with a skilled operator to keep the current to a minimum during the entire starting period. The efficiency of the motor is not affected by the high starting resistance because it is cut out of circuit when the machine is operating under full-load conditions.

Since this method of starting necessitates the use of a phase-wound rotor, slip rings, brush holders and brushes, however, it is more expensive than using a squirrel-cage motor with auto-starter control in the primary. On the other hand, the wound-rotor controller is more durable, having only to short-circuit the resistance steps instead of breaking the circuit. There is less burning out of controller fingers, and the starting operation is quieter, but if the controller handle is moved too quickly over the contacts sudden rushes of current are liable to occur. In order to minimize the cost of the complete outfit, one single resistance step can be used in each phase and assembled on the rotor, thus eliminating slip rings and brush rigging.

For most industrial applications, such as the operation of motor-generator sets, pumps, blowers, line-shafting, cotton mills, wood-working machinery, etc., the internal secondary resistance must not be too high because the efficiency of the machine is directly affected by the copper losses in the secondary; and a slip as high as 6 to 8 per cent is considered prohibitive in such motors.

STARTERLESS MOTORS

Several types of starterless motors have been developed which will be briefly described before comparing them with the motors mentioned. For instance, Boucherot employs two separate fields, one of which is capable of rotation (either mechanically or by means of an induction regulator), the fields opposing each other during the starting period, one being gradually rotated until it coincides with the other in rotation. Another type of motor which is extensively used involves a high-resistance squirrel-cage or phase winding for starting and a low-resistance polyphase rotor winding which is open during the starting period but closed when the

RELATIVE ENERGY CONSUMPTION, HEATING DURING ACCELERATION, AND TIME TO ACCELERATE FOR SQUIRREL-CAGE AND STARTERLESS MOTORS*

Speed (Per Cent Synchronous Speed)	Input to Accelerate (Hp.-sec.)	Average Power Available (Hp	Time to Accelerate (Sec.)	Average Line Current (Per Cent Full-Load Current)	Loss (Kw.-Sec.)†			Temperature-Rise in Rotor (Deg. C.)	
					Rotor	Stator	Total	Bars or Copper	End Rings
0–10	9.6 **9.6**	2.05 **7**	4.60 **1.37**	300 **286**	177 **105**	87.5 **9**	264.5 **114**	10 **18**	36 ....
10–20	28.8 **28.8**	6.7 **16**	4.32 **1.80**	296 **266**	160 **120**	79 **10**	239 **130**	8.2 **19**	32.4 ....
20–30	47.8 **47.8**	13.3 **29.8**	3.60 **1.60**	293 **240**	135 **87**	66.5 **7.5**	201.5 **94.5**	7.6 **10.5**	27.5 ....
30–40	67.8 **67.8**	18.85 **38.3**	3.60 **1.76**	288 **215**	130 **73**	64 **7**	194 **79**	7.2 **12.5**	26.2 ....
40–50	86 **86**	27.2 **43.5**	3.16 **1.98**	278 **185**	105 **64**	52 **5.5**	157 **69.5**	5.9 **11.5**	21.2 ....
50–60	106 **106**	37.3 **45.8**	2.84 **2.32**	265 **145**	85 **46**	42 **4**	127 **60**	4.8 **8.5**	17.3 ....
60–70	124 **124**	45.7 **45**	2.72 **2.76**	247 **120**	71 **37.5**	35 **3**	106 **40.5**	4 **6.8**	14.4 ....
70–80	145 **145**	57.6 **39.8**	2.51 **3.65**	200 **70**	43 **17**	21 **1.5**	64 **18.5**	2.4 **3**	8.8 ....
80–90	165 **165**	148 **58.5**	1.12 **2.83**	365 **230**	64 **47.5**	31.5 **12**	95.5 **59.5**	3.6	13 ....
90–100	180 **180**	95 **65.0**	1.90 **2.77**	180 **130**	26 **15**	13 **4**	39 **19**	1.5	5.3 ....
Squirrel cage total	....	....	30.37	....	....	....	1487.5 †	55.2	202.1
Starterless total	....	....	**22.84**	....	....	....	**684.5**	**89.8**	....

*Bold face type refers to starterless motor.
†Does not include auto transformer losses, which would probably be 20 per cent more, or 1790 kw.-sec.

motor is nearing full speed. Another scheme proposed by Boucherot is to use two squirrel-cage windings, one of high resistance and low reactance active during the starting period, and one of low resistance and high reactance (at the high rotor frequency which occurs during the starting period), to assist the first squirrel cage after the motor has attained full speed. The use of deep narrow slots has been mentioned to increase the skin effect during starting and thus increase the starting torque.

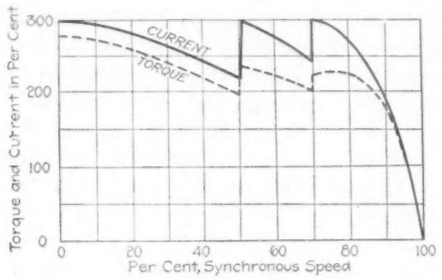
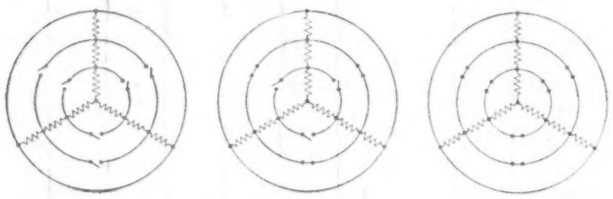


FIG. 6—STARTING CHARACTERISTICS OF SELF-STARTING MOTOR

Motor operates on principle shown in Figs. 4 and 5. The curves are obtained from a 50-hp., 1200-r.p.m., 60-cycle motor and are counterparts of those shown in Fig. 1 obtained from a squirrel-cage motor of the same rating.

To prevent the crawling of squirrel-cage motors at subsynchronous speeds Punga has proposed using a combination of a phase winding and a squirrel-cage winding in which the coils are embedded in slots and connected to an end ring. The pitch is so chosen that one side of one coil lies under a tooth and the other side of the coil lies under a slot opening. The pitch of the coil is such that the seventh harmonic is avoided. J. Fisher-Hinnen had proposed tubes having high specific resistance material as rotor bars, these being connected to end rings in the usual manner. Rods of low-resistance material fitting into these tubes are gradually inserted in the tubes as the motor is speeding up. Use is also made of a three-phase rotor of normal construction equipped with carbon-disk resistors in each phase. As the rotor speeds up centrifugal weights increase the pressure between the carbon disks, thus decreasing the rotor resistance.

A self-starting motor which works on the principle shown in Figs. 4 and 5 has just recently been developed. With this type the initial investment can be minimized and in many instances greater efficiency can be obtained.



FIGS. 7, 8 AND 9—SELF-STARTING ARRANGEMENT OF ROTOR WINDING FOR LARGE MOTORS

The starting torque (Fig. 6) can be made any value up to the pull-out torque of the motor by properly selecting the resistance of A, A_1, B, B_1, C and C_1, and the slip under normal operating conditions can be made relatively low. The practicability of operating the motor by remote control and where it will not receive expert attention is another feature.

By properly selecting the pitch of the rotor winding the tendency to creep or stick at a subsynchronous speed is eliminated. If for any reason the supply voltage fails, the motor stops and the rotor connections automatically return to the starting connections and no damage to the motor due to the supply voltage results. It is this feature which makes this type of motor applicable for remote control.

With the arrangement shown all of the rotor windings are active during the starting period and also while running, but not to the same extent. The completed rotor winding is not different from an ordinary phase-wound rotor, and any difficulties due to assembling the revolving resistance units are eliminated. The centrifugal device for changing the rotor connections from the starting to the running condition is simple and rugged, there being only three rotating switches to be closed. The switches X, Y and Z never break a circuit, thus eliminating burning at the contacts, a most troublesome feature of switches operating in air. In larger machines the windings A_1, B_1 and C_1 of Figs. 4 and 5 are split and short-circuited successively. The performance of a 75-hp. motor having the rotor winding divided as shown in Figs. 7, 8 and 9 is shown in Fig. 10. The torque is equal to $M_2N_2^2I_2^2(R_2' + R_2'')$, where

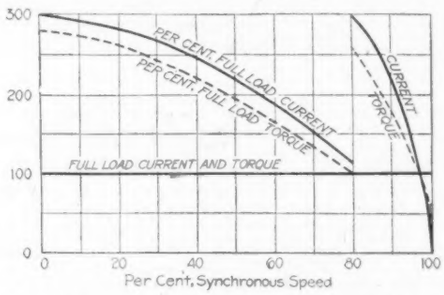


FIG. 10—PERFORMANCE OF MOTOR STARTED BY PRINCIPLE SHOWN IN FIGS. 7, 8 AND 9

R_2' and R_2'' are the resistances of A, B, C and A_1, B_1, C_1 respectively.

Comparison of Energy Consumption and Heating During Acceleration

Data on the relative energy consumption and heating of squirrel-cage induction motors and the self-starting motor just described are given in the accompanying table. To permit comparison it is assumed that the entire weight to be accelerated is concentrated in a flywheel on the rotor shaft, a 60-in. (152-cm.), 750-lb. (340-kg.) flywheel being selected for this example. Three-phase, 60-cycle, 50-hp., 1200-r.p.m. motors having the characteristics shown in Figs. 1 and 6 are considered. In both cases it is assumed that the starting current is limited to three times the full-load current. This puts a premium on the inefficient motor, but in the case under consideration the full-load efficiency and current are approximately the same for both motors, although the distribution of losses is different.

Owing to the fact that the cost of the auto-transformer is eliminated with the starterless motors, it is possible for the same expense to design this machine with somewhat more liberal dimensions than the squirrel-cage motor, use higher rotor resistance, lower primary resistance and obtain lower core losses, thus permitting the same over-all efficiency but improved starting characteristics.

From the data it can be seen that the squirrel-cage motor plus a starter consumes 2.73 times as much energy as the starterless motor to accelerate the same load to full speed. A slip-ring motor, if properly handled, will effect a still greater saving, but the starterless motor is cheaper in first cost and simpler to operate and maintain.

A squirrel-cage motor having the bars and end rings correctly proportioned would give nearly the same results during the starting period, but the full-load slip would be high, the full-load efficiency low and the heating of the machine under continuous operation prohibitive. Such motors are limited in their application to elevator and allied intermittent use.

Government Wages to Electrical Men

Analysis and Classification of Compensation Provided for Next Fiscal Year for More Than 1200 Men Engaged in Different Electrical Occupations That Contribute to the Nation's War Program

IN THE estimates of appropriations required by the several United States government offices and executive departments for the fiscal year to end June 30, 1919, are found the salaries and wages for electrical men of all kinds.

Compensation is not at all regular. Some salaries are on an annual basis, some are monthly, some per diem, and still others on an hourly rate. The list runs all the way from a salary of $4,800 per annum for an electrical engineer to $1.04 per diem for electricians.

Provision is made for a total of 860 electricians, wiremen and helpers. Chief electricians are to receive as high as $2,280 per annum and as low as $1,400 per annum. Electricians are to receive on the annual basis as high as $1,800 and as low as $360; on the monthly basis from $60 to $150, and on the per diem basis from $1.04 to $6. Wiremen are to receive annual payment as high as $1,950 and as low as $900; on the per diem basis from $2.52 to $4.80, and 74 cents hourly. Helpers in a few cases are provided for at an annual or monthly rate. They are generally on the per diem basis, which ranges in their case from $2 to $4. The hourly basis rate is 42 cents.

Electrical engineering talent is generally provided for on an annual salary basis. These salaries range from $1,200 to $4,800. Electrical experts are to receive as high as $12 per diem and as low as $4. Electrical draftsmen will average $5.35 per diem, ranging from $3.76 to $12.48. In the electrical engineering class positions are made for 193 men.

To take care of the various kinds of plant and line work provision is made for 223 men. Generally speaking, these places call for annual or monthly salaries.

All told, the estimates call for the employment of 1276 electrical men. The detailed figures on the number to be employed, the different groups, and the average compensation to be paid, together with the upper and lower limits, are to be found in the accompanying tables:

Number of Electricians and Rate	High	Low
5 chiefs, average $1,776 per annum	$2,280	$1,400
263, average $1,122 per annum	1,800	780
20 from $360 to $1,000 per annum.		
3 from $480 to $900 per annum.		
8, average $119 per month	150	100
2 from $60 to $90 per month.		
3 from $90 to $140 per month.		
349 from $1.04 to $6 per diem	6.00	2.40
9 assistants, average $1,129 per annum	1,240	1,000
8 helpers, average $857.50 per annum	1,080	720
26 helpers, average $2.81 per diem	3.25	2.50
20 helpers, from $2 to $3 per diem.		
3 electricians and helpers from $4.50 to $6 per diem.		
5 electricians and helpers, from $3 to $3.80 per diem.		

Number of Electricians and Rate	High	Low
1 electrical worker, $75 per month.		
2 electrical workers from $480 to $600 per annum.		
14 wiremen, average $1,176 per annum	1,950	900
7 wiremen, average $4.18 per diem	4.80	2.79
6 wiremen from $2.52 to $2.76 per diem.		
94 wiremen, at 74 cents per hour.		
4 helpers, from $2.50 to $4 per diem.		
5 helpers at 42 cents per hour.		
3 wiremen and helpers, $600 to $840 per annum.		
ENGINEERING		
57 electrical engineers, average $2,136	$4,800	$1,080
3 electrical engineers and mechanical engineers, average $2,017	2,250	1,800
1 electrical engineer and draftsman, $1,400.		
1 chief electrician and mechanical engineer, $2,500.		
4 electrical expert aides, average $9.64 per diem	12.00	4.00
1 electrical expert aide at $1,800 per annum.		
1 assistant electrical expert aid at $5.76 per diem.		
23 electrical draftsmen, average $5.35 per diem	12.48	3.76
1 draftsman and electrical expert, $8 per diem.		
6 electrical copyists, $2.92 per diem.		
1 assistant engineer and electrician, $1,800 per annum.		
8 engineers at $1,375 per annum	1,600	1,200
17 electrical machinists or machinists and electricians, average $1,294 per annum	1,400	1,200
10 electrical assistants, average $1,280 per annum.	1,500	1,200
67 electrical inspectors, average $1,740 per annum.	2,000	1,200
1 electrical inspector, at $8.40 per diem.		
PLANT AND LINE WORK CONSTRUCTION		
1 foreman at $1,100 per annum.		
1 wire chief at $1,875 per annum.		
8 cable splicers, average $142 per month	$165	$74
1 cable erector at $1,800 per annum.		
1 superintendent of maintenance and construction, $300 a month.		
1 chief lineman at $1,200 per annum.		
1 foreman lineman at 87½ cents per hour.		
1 foreman lineman at $900 per annum.		
15 linemen, average $155 per month	150	110
6 linemen, average $4.24 per diem.	4.96	3.75
4 from $4 to $6 per diem.		
33 at 70 cents per hour.		
2 high-tension linemen at $175 per month.		
PLANT		
5 supervisors, average $225 per month	$250	$200
23 foremen, average $169.50 per month	200	135
2 power superintendents, average $225 per month.	300	150
2 stationary engineers at $225 per month.		
1 electrical recorder at $200 per month.		
3 wiremen operators, at $165 per month.		
21 switchboard operators, average $155.28 per month	187.50	140
3 substation operators, at $1,200 per annum.		
2 telephone operators, average $97.75 per month.	103.50	92
2 operators, from $75 to $90 per month.		
3 operators, at $90 per month.		
25 chauffeur-operators, at $75 to $120 per month.		
14 dynamo tenders, average $995 per annum	1,080	875
7 dynamo tenders, at $4 per diem.		
8 skilled laborers, at $2.50 per diem.		
6 wheel tenders, at $2.50 per diem.		
9 battery repairmen, average $151.40 per month.	162.50	137.50
1 instrument repairman, average $165 per month.		
7 signal maintenances, at $150 per month.		
1 engine man and erector, at $900 per annum.		
3 switchboard men, at $360 per annum.		

Standardization of Overhead Construction

Considerations That Were Taken Into Account in the Determination of the Types of Line Construction Now Used—A Numerical System of Specifying That Has Been Found of Assistance in the Reduction of Costs

BY H. E. WULFING
Commonwealth Edison Company, Chicago

STANDARDIZATION of construction in any line of work results in decided advantages at any time, but especially so under present conditions. There are a few advantages peculiar to overhead line construction which will bear emphasis. First, standardization eliminates the carrying in stock of special material to satisfy the ideas of the several foremen or superintendents engaged in the work. Next, it reduces the amount of material which has to be carried in stock by reducing the number of kinds of units needed. Third, it permits of accurately determining in advance the correct amount of material needed on each job, since the material for each standard is definitely known and the material for a job will be equal to the sum of the material for the standards in connection with the job. In addition, it increases the efficiency of the gang, owing to the fact that the repeated performance of a job in a definite way increases the speed with which it is done. Again, it establishes uniform construction throughout the system. Sixth, it permits a comparison of the relative value of the gangs, as each gang does the same units of work in the same manner. And last, but not least, it reduces the cost of doing the work.

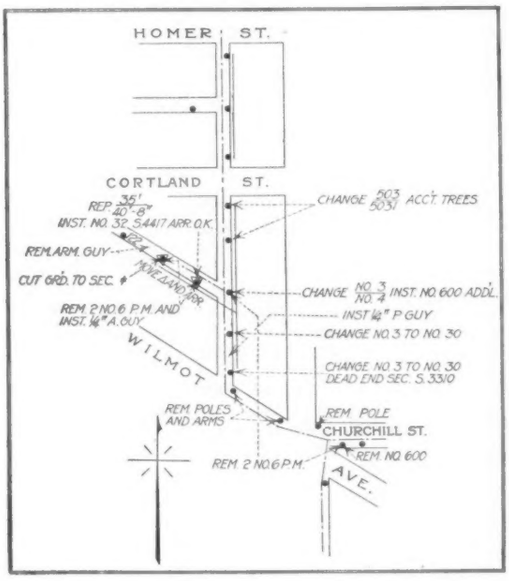

HOMER ST.
CORTLAND ST.
REP. 35' 40'-8"
INST. NO. 32, 5-4417 ARR. O.K.
REM. ARM. GUY
CUT GRD. TO SEC. ¢
REM. 2 NO. 6 P.M. AND INST. ¼" A. GUY
WILMOT
CHANGE 503 TO 503 ACC'T. TREES
CHANGE NO. 3 TO NO. 4 INST. NO. 600 ADD'L.
INST. ½" P GUY
CHANGE NO. 3 TO NO. 30
CHANGE NO. 3 TO NO. 30 DEAD END SEC. S. 33/0
REM. POLE
CHURCHILL ST.
REM. NO. 600
REM. POLES AND ARMS
REM. 2 NO. 6 P.M.
AVE.

FIG. 1—TYPICAL METHOD OF INDICATING WORK ON JOB ORDER

The establishment of standards for overhead construction is not so simple as in most other work, however. No two jobs are alike and, while the elements of a job may be similar, the conditions under which it will be done are different in each case. However, if overhead line work is to be made uniform, simple, neat in appearance and easy to designate, there must be standards. The method of establishing such standards for the Commonwealth Edison Company of Chicago are given in the following paragraphs.

In this program of standardization, which extended over a period of two years, several requirements were considered. They were safety, simplicity, neatness in appearance, uniformity, practicability, fitness for a progressive construction program, and cost.

How Cable Pole Construction Was Standardized

In order to give a concrete illustration of the manner in which some of these requirements have been met, the steps followed in standardizing a cable pole will be explained. When the standardization of cable poles was considered it was found that there were several types of construction in existence. This condition existed because men in charge of work in various districts had followed their own ideas and worked independently. The best type was selected, and the question of safety was first considered. This pole contained six alley arms and three buck-arms and was designed to carry twelve potheads. It was found that the safety of the pole could be improved by adding another arm, on which the linemen could stand while inspecting lightning arresters. This further loaded the already overburdened and unsightly pole. While the question of safety had thus been taken care of, simplicity of construction and neatness in appearance had been neglected. In order to attain this it was necessary to reduce the number of arms on the pole.

It was found that the number of cases in which it was necessary to install twelve potheads on a cable pole were few. Therefore it was decided to design the cable pole for eight potheads, taking care of the cases in which twelve potheads were needed by setting another cable pole. This permitted the reduction of the number of buck-arms by one. The standing arm, which was originally installed for safety in inspecting lightning arresters, was then eliminated by installing the non-inspecting type of lightning arresters. Further consideration resulted in the elimination of services from the cable pole, and a standard was finally adopted having only three buck-arms and four line-arms as

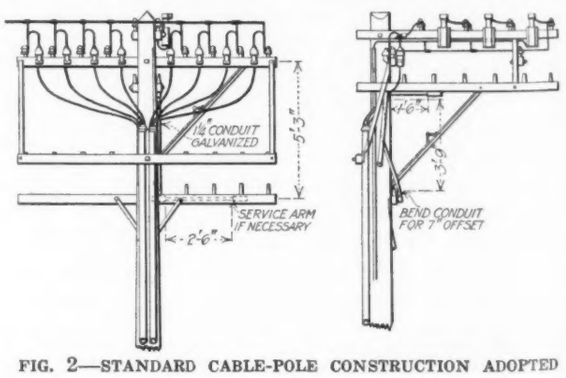


FIG. 2—STANDARD CABLE-POLE CONSTRUCTION ADOPTED

against the old type, which had four buck-arms and seven line-arms. The new standard (Fig. 2) is safer, simpler, neater in appearance, more practicable and costs less than any construction which was formerly used.

A good illustration of progressive construction is given by the present type of standards for transformer

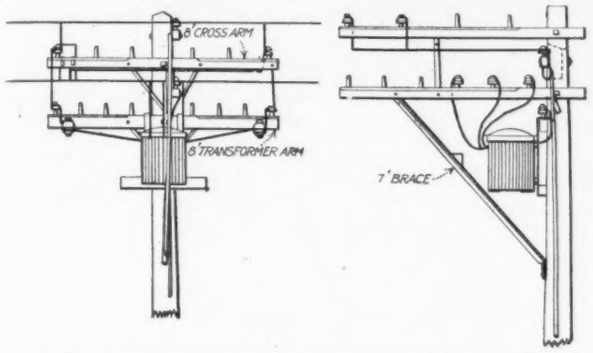


FIG. 3—TYPICAL CONSTRUCTION FOR SMALL TRANSFORMER INSTALLATIONS

installations. An investigation of the different types of construction brought out the fact that, as was found with the cable poles, there were many methods of installing transformers. It was also found that as the load on a transformer increases, and it is necessary to increase its size and therefore increase the strength of the equipment for holding the transformer, it would be practically necessary in most cases to dismantle the previous construction and rebuild the transformer pole. Safety and appearance were already fairly well taken into consideration, so that the main question was one of progressive construction.

In the plan which was finally adopted the transformers are divided into groups with a type of installation for each group. The installations are so planned that when it is necessary to increase the size of a transformer of one group to the next larger it is merely necessary to add another arm without disturbing the existing equipment other than the transformer itself. Incidentally, simplicity and neatness in appearance were attained by providing heavier arms to sup-

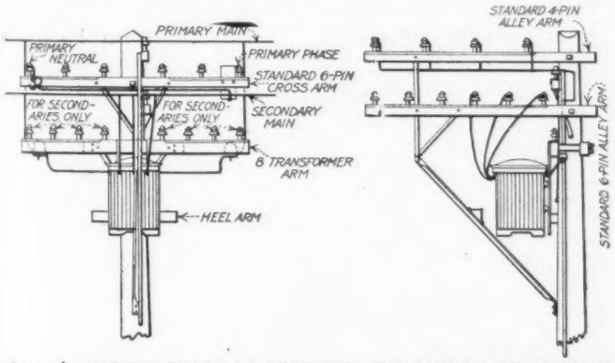


FIG. 4—AMPLE SPACE IS PROVIDED FOR LARGE TRANSFORMER BY BRACING USED, WHILE EXTRA STRENGTH IS AFFORDED BY DOUBLE BUCK-ARM HOLDING TRANSFORMER

port the transformers rather than by doubling the smaller sizes of arms (see Figs. 3 and 4). A change from the construction shown in Fig. 3 to that in Fig. 4 can be made by merely adding a short buck-arm for additional strength without any change in wiring.

Once having established a standard, there are two things to be accomplished in order to put this standard into effect: First, to familiarize the man on the job with the construction standard; second, to devise a scheme for specifying the standard on the job print. In order to keep the man on the job in touch with standard construction, each gang foreman is supplied with a book of standards known as the "Overhead Construction Specifications." This book is pocket-size and contains a description of the methods of construction and prints of all the standards commonly used, together with a list of material for each type of construction. The foreman is thus furnished with authoritative information on whatever work he has in hand.

On account of the large number of standards of overhead construction, it was evident that some system of symbols must be adopted in order that the standards

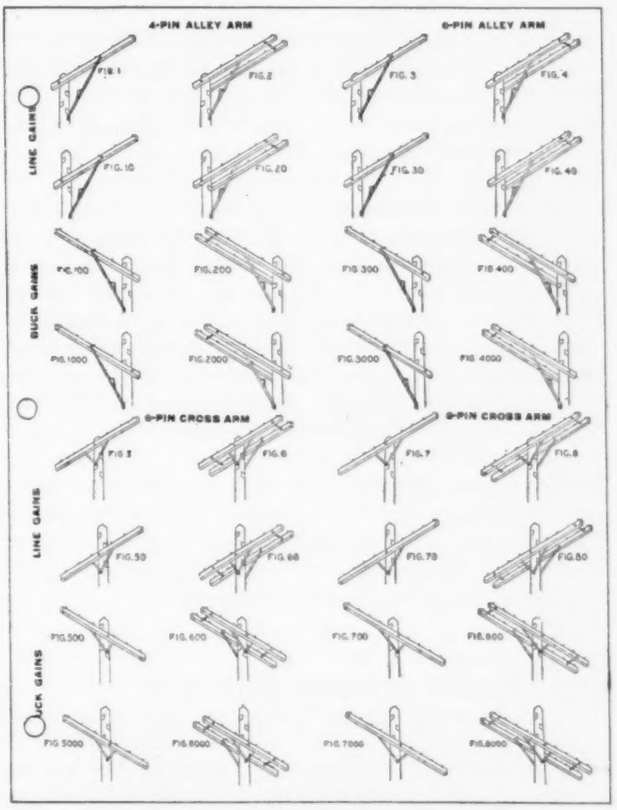


FIG. 5—POLE-TOP CONSTRUCTION CLASSIFIED BY POSITION OF CROSS-ARMS ON POLE

might be classified and to permit ease of reference and specification on the job print. For this purpose the standards are divided into groups according to types—for example, cable poles in one group, transformer poles in another, line poles in another, etc. To each group is given a series of numbers sufficient to take care of the present standards and to allow for future standards that may be established. These symbols or numbers for designating the different types of standard construction permit ready reference to the various groups and allow the use of simple specifications on the prints and job sheets. The foreman and men soon become familiar with the symbols and refer to the types of construction by symbol numbers instead of by description.

In attempting to establish standards for the overhead work, it was found that they naturally divide themselves into two groups—one line poles, the other special

poles. The number of special poles is limited, and it was a simple matter to assign symbol numbers to them; but when it came to the question of assigning symbol numbers to line poles it was found that there were so many possible combinations of arms on a pole that the making of a sketch and assigning symbols to each combination was out of the question. It was therefore necessary to establish some scheme that would permit the definite designation of the arming of a line pole without the necessity of assigning to each group of arms a separate sketch and symbol.

Study on a scheme of this kind resulted in the application of a decimal system (Fig. 5) for designating the arming of line poles. For instance, referring to the group of small figures in this illustration, Fig. 1 is a four-pin alley arm on the top line gain. When placed on the second line gain it is called Fig. 10; on the first buck gain, Fig. 100, and on the second buck gain, Fig. 1000. The arm doubled is designated by the next even number. In other words, the number designates the arm, and the units, tens, hundreds or thousands in a figure designate the position of the arm on the pole. For example, Fig. 30 represents a six-pin alley arm on the second line gain—the figure 3 identifying it as a six-pin alley arm, and its being in the tenth position identifying its location on the second line gain.

The specifying of the arming of a line pole is thus reduced to a symbol consisting of no more than four digits, and any combination of four arms, either single or double, on any of the four positions can be specified by means of the decimal system shown. To illustrate further: Fig. 632 designates the arming of an ordinary line pole from which a service is taken and specifies that a double four-pin alley arm is installed on the top line gain, a single six-pin alley arm on the second line gain and a double six-pin buck-arm on the first buck gain. The simplicity of the designating of the arming of line poles should be evident.

STATUS OF POWER SUPPLY IN THE JAPANESE EMPIRE

Installed Capacity of Electrical Plants Is More Than 500,000 Kw., with 460,000 Kw. Additional Under Construction at Close of 1917

According to the official publication of the Department of Communications, the status of electrical industry in Japan at the close of 1917 was as follows: Central stations, 582; electric railways, 40; central stations and railways, 48, a total of 670, or an increase over 1916 of 42.

Total capital for central stations, $182,347,955; for railways, $21,423,985; for railway and central stations, $159,443,346, making a total of $363,215,285, an increase over 1916 of $31,038,335.

The generating capacity in kilowatts at the close of 1917 for the different classes was as follows:

	Central Stations	Railways	Central Stations and Railways	Total	Increase Over 1916
Completed:					
Water	327,458	180	73,799	401,439	26,553
Coal	49,251	1,175	64,936	115,362	5,667
Under construction:					
Water	278,911	850	17,307	297,068	44,738
Coal	118,419	3,450	41,400	163,269	137,674
Total:					
Water	606,369	1,030	91,106	698,505	71,291
Coal	167,670	4,625	106,336	298,631	132,007
Both	774,039	5,655	197,442	977,136	203,298

Safest on Earth—Liberty Bonds

Book Review

THE LIGHTING ART. By M. Luckiesh. New York: McGraw-Hill Book Company, Inc. 230 pages, 43 illustrations. Price, $2.50 net.

This latest of Mr. Luckiesh's admirable little books on light and color deals particularly with the artistic side of the subject in its various forms of application. The engineering technique of lighting has been many times dealt with in other specialized books, but, since Mrs. Gordon's "Decorative Electricity" many years ago, this is the first which has been devoted chiefly to the artistic finesse of artificial lighting. It therefore forms an admirable supplement to the literature of illumination. Particular attention should be directed to Mr. Luckiesh's consideration of artificial daylight and other special color modifications of illuminants. He is, perhaps, a little optimistic regarding artificial daylight and its applications, a most interesting development which has not yet proved especially fruitful. There is a subtle psychological situation which lies back of simulated daylight. To the ordinary eye all varieties of so-called artificial daylight look blue if anywhere nearly fully developed toward their ideal. The north sky is, of course, notorious for its large proportion of blue light, but this tone is strongly modified in interiors, so that if an artificial illuminant matches real north-sky light it still appears, if at all concentrated, strongly blue to the eye. None of the artificial daylights as yet produced is entirely free from objection, but they can be and are made to produce all degrees of approximations to the various phases of natural light. It is not so much the amount of variation from natural light that is important as it is the kind, and Mr. Luckiesh points out that certain devices producing an apparently good simulation are still bad on account of their weakness in certain colors. A given tint can be very closely matched by lights varying enormously in spectral composition. If the variation is in the usual direction suggested by a comparison between north sky and sunset, the eye, accustomed to just this particular kind of variation in its daily life, takes relatively little cognizance of it.

Another modification that enters into the subject and is briefly discussed by Dr. Luckiesh is the toning of relatively white electric lights to the warmer and to many eyes more pleasant hue produced by candle flame or oil lamp. The interesting point about this special problem is that the illumination thus toned can be obtained at a very much higher efficiency than that actually obtained for a similar color in using the old carbon lamps. This fact depends on the nature of the color filtering, which has proved to be a very difficult task, particularly since the most efficient color screens are of dyes which have been found to be somewhat fugitive. Mr. Luckiesh's volume should prove interesting to the general reader and particularly valuable to architect and decorator.

Buy Bonds, Still More Bonds

Condition of Electric Utilities in the War

Economic Factors Are Menacing, but They Are Balanced to a Certain Extent by Position of Companies as "Essential" Industries and Assurance of Great Demands for Power

WAYS of meeting the unprecedented conditions under which public utilities labor are discussed in reports to stockholders. Many details of special interest to the companies are presented from experience and they show that great care and wise forethought are needed to guide the properties through the troublesome problems of the present year. While readjustments of rates have been made in many communities, these changes alone have not removed all difficulties. Even where these increases have been approved by the state regulating commissions, they are not always adequate. The paramount issues of insufficient generating capacity to meet war demands, of cost as well as scarcity of materials, of uncertainty as to revenues and of depletion of forces by the national military exigency remain menacing. The shifting conditions which these influences promise for the future look serious, but they are certainly balanced to some extent by the fact that the utilities are in no doubt as to their rank as "essential" industries. Whatever else happens, the great electrical generating and distributing systems are assured that their output is one of the first products required for public service and winning the war.

PUBLIC SERVICE CORPORATION

Reviewing the 1917 operations, President Thomas N. McCarter of the Public Service Corporation of New Jersey said:

"The enormous increase in the cost and the shortage of labor; the vast increase in the cost of every commodity used in the operation of these properties, and the difficulty of obtaining materials all combined to create an unprecedented situation which is reflected in smaller depreciation charges and net earnings. The fuel bill alone of the three operating companies was approximately $2,500,000 in excess of what it would have been for the same amount at 1916 prices."

The amount spent in maintenance, however, says Mr. McCarter, "largely exceeded that spent in previous years, owing to increased cost of labor and materials, and the properties have been well maintained."

Reference is made to the application for rate increases. A new electric schedule was authorized recently by the New Jersey commission.

The services of 833 trained men were lost to the operating companies, that number of employees having joined the army and navy. "While their loss is felt, this manifestation of loyalty to country is a source of gratification," Mr. McCarter adds.

In addition to serious difficulty in securing coal, the subsidiary Public Service Electric Company was materially handicapped "by the failure of manufacturing contractors, owing to war conditions, to deliver apparatus and supplies as promised." Nevertheless, much new construction was completed or begun.

"The policy of furnishing power in large amounts to customers at transmission voltage was continued, and the tremendous demands made upon the company for war purposes necessitated a number of important installations of this character," writes Mr. McCarter. "It may be interesting to note that it is estimated that 67 per cent of the company's connected power load is being utilized indirectly in war business."

The net charge for capital expenditures by the Electric Company in the year was $4,880,463.

NORTH AMERICAN COMPANY

President James D. Mortimer of the North American Company says that the process of procuring adjustments to compensate for increased costs of labor, fuel, supplies, taxes and money is very slow.

He declares that "public utilities are confronted with that same psychological inertia which has for years confronted the steam railroad carriers and brought about the congestion of facilities which reached its climax during the winter."

Mr. Mortimer expresses the hope that it will prove fortunate in the long run that the regulating commissions having jurisdiction over the utilities in the states in which the subsidiary utilities operate have not hesitated to assume jurisdiction over applications for increased rates.

Concerning financing and new construction, Mr. Mortimer writes:

"Immediately after the decision which resulted in the United States joining in the world war all the subsidiary companies put into effect changes by which their plans for expansion of plant and facilities were greatly contracted. Only that construction work was continued which was necessary to avoid losses or to carry out contracts incurred in prior months. Permanent financing of much of their capital expenditures has been impossible except at interest rates higher than the returns yielded by the business during even normal times. Depreciation reserves accrued during the year have been invested in additional plant and facilities and in materials and supplies. A very restricted construction program during the year 1918 and subsequent years as long as the war continues will leave reserve accounts available for the gradual payment of the indebtedness incurred during the year just closed."

Coal price fixing, says Mr. Mortimer, "has granted only partial relief. Operating expenses have been raised to a high plane from which complete relief is not yet in sight. Unit operating revenues have as a rule continued to decline, and the margin between revenues and costs has been contracted from both directions."

A temporary increase in electric rates of the Milwaukee Electric Railway & Light Company has been authorized by the Wisconsin Railroad Commission.

In discussing the affairs of the Missouri subsidiaries Mr. Mortimer mentions the acquisition by the Union Electric Light & Power Company of St. Louis of 3200 acres of coal lands. The property is near Duquoin, Ill.,

75 miles from St. Louis. The amount of workable coal is estimated at 36,000,000 tons, and the development of production is planned during 1918.

Referring to the successful policy adopted by the Union company of selling preferred stock to customers, Mr. Mortimer says that up to Dec. 31, 1917, a total of $1,903,300 was subscribed.

As indicative of capital expenditures in 1917 the reports of some of the principal North American Company subsidiaries may be given. Expenditures of the Milwaukee Railway & Light Company, for additions, extensions and betterments, other than purchase of the Commonwealth Power Company system, amounted to $2,328,405. Milwaukee Light, Heat & Traction Company expenditures were $1,068,292, and those of the Wisconsin Gas & Electric Company were $920,128. For the Union Electric Light & Power Company of St. Louis the total, excluding purchase of the Electric Company of Missouri, was $3,537,012, but because of the removal from service of property valued at $829,208 the net amount was $2,707,804.

Cities Service Company

The radical change in operations of the Cities Service Company is pointed out by President Henry L. Doherty in a statement showing the sources of gross revenues. In 1915 public utilities furnished 95 per cent of the $4,479,800 total and oil operations 5 per cent. In 1916 public utilities contributed 55 per cent of the $10,110,343 total and oil 45 per cent. In 1917 the aggregate amount was $19,252,493, of which public utilities furnished 24.6 per cent and oil 75.4 per cent.

Speaking of fuel and labor costs and the cost and difficulty of delivery of supplies, Mr. Doherty said:

"Government restrictions and regulations regarding decorative and sign lighting and the development of the federal policy of safeguarding and extending service to essential industries by the curtailment of supply to non-essential users have introduced additional problems into an already difficult situation."

It became apparent, Mr. Doherty continues, that "service, earnings and investments could be protected only by increasing rates." Nearly every subsidiary was called upon to make adjustments. While this work was complicated by variations in rate-making authority in different states, consent was obtained during the year to adjust power and industrial rate schedules for practically every property.

After speaking of the new plant construction at Toledo, Mansfield, Ohio; Joplin, Mo., and Warren, Ohio, Mr. Doherty says: "Extensions to meet large industrial war requirements are under consideration. Progress on these, however, will be affected by plans for financing such requirements."

More than 750 employees entered government service, and President Doherty remarks that "it should be a source of patriotic satisfaction to all stockholders that the business of the subsidiaries is of essential usefulness in the prosecution of the war."

Southern California Edison Company

The last year was one of material expansion for the Southern California Edison Company, Los Angeles.

Acquisition of various properties makes the company, with its constituents, President John B. Miller writes, "one of the largest in size of the great central-station systems of the United States." The ramified system serves approximately 1,500,000 population. The electric properties comprise seventeen hydroelectric and eight adjunct steam-generating stations with combined capacity installed of 302,430 hp.

"In general," Mr. Miller says, "we have endeavored to administer the affairs of your corporation along public-spirited, patriotic lines." In addition to the 280 officers and employees who have joined the colors, two directors are "dollar-a-year" men in Washington.

W. A. Brackenridge, vice-president and general manager, notes that the interconnection of systems, putting into fullest use all developed hydroelectric power in Southern California, will result, based on average water conditions, in a saving of 781,000 barrels of oil per annum, equal to 75 per cent of the 1917 oil consumption by these properties.

Power is needed, water powers are running to waste. Mr. Brackenridge declares that to provide for increasing demand the work of completing and placing in operation additional plants "should be undertaken at the earliest possible moment." More than 800,000 undeveloped hydroelectric horsepower is available in watersheds in which the company's principal power plants are located. Immediate necessities could be met by two installations providing 60,000 hp. more for $8,500,000.

"Their output in substitution for steam power," adds Mr. Brackenridge, "would conserve approximately 1,100,000 barrels of oil per annum during average water years."

At request of the federal Fuel Administrator, the company has signified its willingness to distribute the output of additional small hydroelectric plants of the city of Los Angeles over its system in substitution for steam-plant generation with fuel-oil consumption.

"All necessary and reasonable requests for service received prompt attention," Mr. Brackenridge says, although financial conditions were not favorable for heavy expenditures during the latter part of the year.

While power was in demand from every quarter it is significant that the greatest increase in demand has been for agricultural purposes.

"There is every indication," Mr. Brackenridge states, "that the demand for electric energy for power service in southern California will be unusually heavy in 1918. The agricultural business has been enormously stimulated. The question with the average farmer to-day is, not, Shall electric power be used for pumping water? but, rather, Can electric power be obtained?

"Along industrial lines every present condition in connection with fuel costs, scarcity of materials and increased operating expenses indicates that electric energy is what every manufacturer wants and must eventually have. Under existing conditions the principal problem for the company will be to obtain deliveries of material and equipment to keep up with the increasing demand for energy which must surely come."

That part of the total load which might, on a war basis, be termed "non-essential" does not exceed 10 per cent, the remaining 90 per cent being for transportation, agriculture, shipbuilding and general manufacture essential to the successful prosecution of the war.

It is necessary, continues Mr. Brackenridge, "to provide for considerable extensions to distributing systems and for additional hydroelectric equipment." Capital expenditures in 1917 were $3,716,092.

Transformer Inspection as Economic Measure

Chances of Failure Are Decreased if Transformers Are Issued Thoroughly Clean and Dry and with Leads and Bushings Intact—Practical Methods of Caring for Apparatus and Detecting Flaws

THOROUGH inspection of all distribution transformers returned from the lines should be made before they are again issued for service, first to lessen the chance of failure after replacement on the lines, and second to minimize the labor required in making the installation. Chances of failure are decreased if transformers are issued thoroughly clean and dry and with leads and bushings intact. Moreover, it is evident that minor repairs and adjustments can be made better and cheaper in the shop than by the installation crew in the field.

Bushings Need Close Attention

Bushings should always be carefully examined, as they are a frequent cause of failure. This is particularly true of the higher voltage classes (11 kv. to 22 kv.) owing to their sizes and greater liability to breakage. A break is not always evident from a casual examination, and each bushing should be shaken to disclose any looseness. A broken or loose bushing, especially a primary bushing, should always be repaired before the transformer is again utilized, since it is almost certain to break down in wet weather and may, under certain conditions, cause a burn-out of the transformer windings.

As most bushings are broken in handling transformers after shipping crates have been removed, means should be provided for protecting them. This is especially necessary with the corner bushings of the flaring petticoat type used in transformers designed for moderately high distribution voltages since the insulators project beyond the re-entrant corners in the case. Some companies provide wooden angles which are bolted to the hanger lugs and encircle the bushings, thus eliminating breakage when the transformer swings against an obstruction.

Although more liable to breakage, double petticoat bushings with long leakage surfaces and deep recesses seem to give better service than the straight or corrugated types. The recess seldom becomes entirely filled with oil and dust, regardless of how much the lead may siphon oil. Furthermore, leakage will not occur across the clean surface between the two parts of the shell. On the other hand, the cylindrical types, whether plain or corrugated, usually become coated with dust whenever there is any oil leakage, and breakdown often results.

In renewing bushings in any line of transformers advantage should be taken of the most recent designs that may be accommodated in the outlet holes. Thus it will be found that the early white cylindrical types may in some instances be replaced with corrugated brown glazed bushings, which, having a longer leakage surface, are less liable to break down.

It is important that bushings which are suitable for the service be chosen. Substitutions should not be made unless the new type is superior to the old. A full supply of spare bushings should be carried in stock so that makeshifts will be unnecessary. A blue-print schedule showing the catalog numbers of primary and secondary bushings required for each tank number should be prepared with the assistance of the manufacturers for each line of transformers handled. This will be found of service both in expediting purchases and in selecting repair parts from store-room stock.

When installing new bushings a grade of sealing compound such as is specially recommended by the manufacturers for this purpose should be used. All of the old compound should be removed before the new bushing is placed. If the bushing is of the type set in with babbitt (those inserted from the outside are usually set in with babbitt, paper lock washers or some similar device), this metal also should be completely removed. In chipping out old bushings and compound provision must be made for catching the scraps to prevent their falling into the coils or bottom of the case. Bushings of the curved styles are best made up complete with leads before insertion in the transformers. The more simple styles, which are easily filled with compound, may be filled in place.

Heating Compound to Right Temperature

Care must be taken to heat the compound to the proper temperature before pouring; otherwise cracks will result. The entire corner of the case in which the bushing is placed should be heated so that the compound will not be chilled on striking the metal. To chill the compound will often result in a leak between it and the case. Much of the oil leakage which occurs around leads and bushings is not caused entirely by siphon action along or through the lead, but may be due to cracks between the bushing and the sealing cement or between the latter and the case. This leakage will not occur unless oil is slopped onto the compound, but it is practically impossible to avoid this in handling a filled transformer. To avoid leaks of this character, not only should hot compound be used, but the surface of the compound above the bushings should always slope in toward the center of the case. This can be effected by tilting the transformer while the compound is being poured as well as while it is hardening. Where the compound must be built up a temporary paper dam may be installed, and after the cement has set it can be removed. This scheme also makes it possible to raise the level of the cement above the top of the bushing so that the bushing and recess may be filled in one operation.

Bushings should be kept clean. It is a good plan to incorporate in all directions covering the installation of transformers a note to wipe bushings carefully after the transformer is in place. Most of the oil and dust which, if left on a bushing, are so likely to cause breakdown are accumulated during transportation from the store room to the job. If the bushings are cleaned after the transformer is hung, this cause of trouble is largely avoided. When transformer tanks are being painted care must be taken not to get paint on the bushings, as

the rough paint surface will tend to gather dust. Bushings of the larger types should be wrapped with cloth or paper while cases are being painted.

How Trouble with Leads May Be Prevented

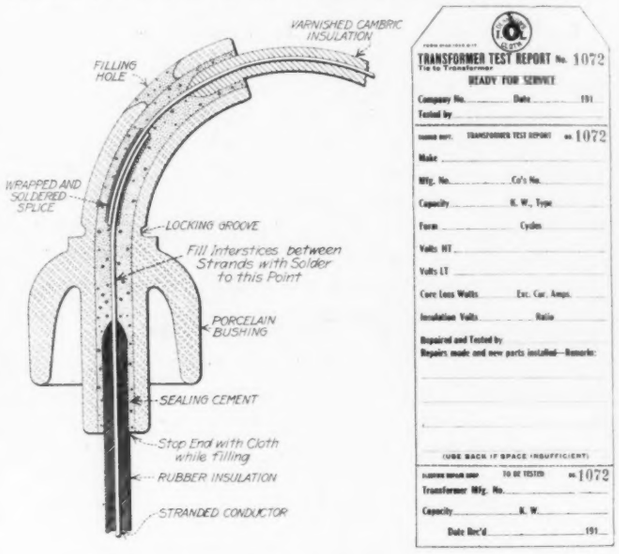
Next to bushings, leads require most frequent attention. They are often broken in handling or are cut short when transformers are removed. In addition, they deteriorate because of the siphoning of oil. Secondary leads of the types of transformers under discussion are invariably rubber-covered. Primary leads are usually rubber-covered, although some manufacturers have recently used varnished cambric insulation for voltages of 11 kv. and up. Each material has its advantages. Rubber withstands weather and moisture well, but it is deteriorated rapidly by oil. This weakness is its most serious defect as oil is often siphoned over the leads. Varnished cambric, on the other hand, while benefited by oil, does not withstand weather well when protected only by a braid covering. It is easily dried out by hot weather and is liable to absorb moisture in wet weather. These remarks apply, of course, only to the leads outside of the case; those inside are always insulated with varnished cambric.

In arranging for shop repairs to transformer leads it is first necessary to prepare a schedule of cables to be used in making renewals, in order to secure uniformity in purchases and repairs. This is preferable to attempting to replace the old lead with one precisely similar in size, insulation and stranding to that installed at the factory, since in the past manufacturers have differed considerably as to these details in transformers having identical ratings. To follow these deviations would require an unnecessarily elaborate stock of cable. A schedule which has proved satisfactory in practice is given herewith for two classes of transformers, for an 11,000-volt and a 2300-volt line. The cables selected, especially those used for primary leads, have not been chosen exclusively on a basis of their usefulness as transformer leads, but also with a view to their use in the wiring of substations and similar work, in order to avoid the carrying of overlapping stocks. All cables are specified as single-braid, rubber-covered. However, if any are to be used extensively in outdoor work, as for instance in wiring between cut-outs and transformers, they may be specified as single-braid and tape. The rubber insulation is 30 per cent Para for the 11-kv. leads and N. E. C. for the others.

It is evident that cable much smaller than No. 6 might be used for the smaller sizes of 11-kv. transformers. However, the expensive part of cable is the insulation, therefore little saving per foot can be effected by ordering a smaller size. Since this size is used extensively in transformer installation wiring, short pieces are usually available for leads which might otherwise be wasted.

The greatest difficulty in installing leads is to prevent the siphoning of the oil. If this happens, the oil will rapidly deteriorate the rubber of the leads and in addition will gather dirt on leads and bushings and thus increase the danger of breakdown. Where the primary terminal blocks are under oil, as is the case in most recent types of transformers, solid conductors may be inserted between terminal block and bushing to prevent the siphoning which would be caused if stranded leads were used. Where stranded conductors are used the splice between the inside portion of the lead (which is insulated with varnished cambric) and the outside rubber-insulated part, as well as all interstices between strands for a short distance on each side of the splice, should be thoroughly filled with solder.

The splice in primary leads should be placed so as to be completely surrounded by sealing compound, and the short, bare and solder-filled portions on each side of the splice should likewise be covered (Fig. 1). A wrapped splice is generally used. Secondary splices and some of the simpler primary splices are placed above the compound. The varnished-cambric insulation of the secondary should be started above the oil level. After filling a bushing with compound, tape should be wrapped around the outgoing lead at the point where it leaves the bushing to prevent the compound from running out before it has set. After the cement has hardened this tape should be removed; otherwise all the oil which may leak between lead and compound will gather at this point and rapidly eat away the insulation.



FIGS. 1 AND 2—BUSHING CONSTRUCTION THAT PREVENTS SIPHONING; THREE-PART TRANSFORMER TEST REPORT

Instructions should be issued to line crews cautioning them against handling transformers by the leads. Transformers are frequently dragged along the ground or truck bed by the leads or are kept from swinging into the pole when being raised by lines attached to the leads. This practice results in many broken leads and bushings.

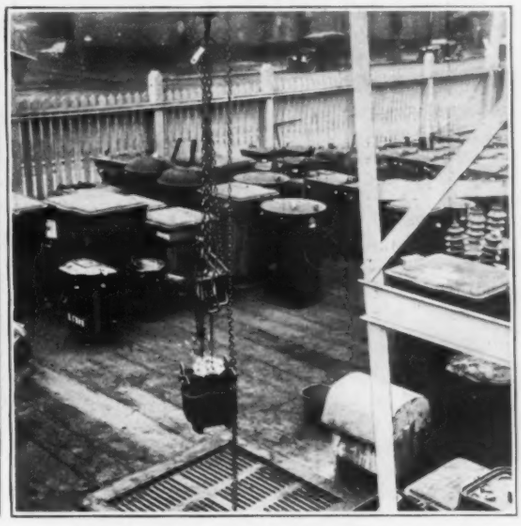
When new leads are installed they should be made long. In some types of pole installations one additional foot of primary lead will permit direct insertion of the lead into the primary cut-out without a splice.

Some line foremen make use of the connectors provided on the leads by manufacturers, and use care in handling them; others appear to consider them superfluous and often cut them off. Instructions should be given to use these whenever present, as they are considerable labor savers, especially in the larger sizes, and will give no trouble if properly installed. Any connectors which are not used should be left taped to one of the leads so that they will be available if necessary in some future installation. In removing transformers foremen should be cautioned to cut the feeds between the connectors and the line and not the leads between

the connectors and the transformers. The connectors may then be saved in the shop. Many leads are cut so short through carelessness that they must be replaced before the transformer can be reissued for service.

PAINTING OF CASES AND CARE OF OIL

Cases should be repainted whenever transformers are brought in from the lines, unless they have been installed only a short time. Sheet-steel cases especially will deteriorate rapidly unless protected by paint and if rusted should be given two coats. Before paint is applied it is necessary to clean the case thoroughly with distillate and a steel-wire brush to remove all dirt and oil. A good quality of turpentine asphaltum paint will be found serviceable for this work. If a system of company numbers is in use, numbers should be restenciled on transformer cases as soon as they are slightly obliterated. A white-lead and linseed-oil paint should be used for this purpose. Stencils 2½ in. (6.35 cm.) high may be readily deciphered from the ground, still



FIGS. 3 AND 4—TRANSFORMER STORAGE YARD WITH CRANE FOR HANDLING APPARATUS AND GRID-COVERED PIT IN WHICH TRANSFORMERS MAY BE LOWERED FOR DRYING OUT

they are small enough so that four or five figures may be placed on the smaller-size cases.

If the transformer has been installed for several years, it is preferable to draw off the oil for testing and treatment as soon as it arrives on the testing platform. On the other hand, if the transformer has been on the lines only a short time and the oil seems clear and without a burned odor, it need not be removed. In the case of the larger sizes of distribution transformers, a sample should be drawn from the bottom of the case with a "sneak" for a moisture test. All transformer oil should be carefully tested, handled and stored in accordance with the recommendations* of the apparatus committee of the National Electric Light Association. Linemen cannot be cautioned too often against handling oil in the open in damp or foggy weather. Companies utilizing distribution transformers of two voltages, as, for instance, 13,200-volt and 2300-volt equipment, will do well to reserve new oil for the higher-voltage equipment and use the second-hand treated and filtered oil in the lower-voltage apparatus.

When possible, transformers should be filled with oil before they leave the storeyard; this, however, is not always possible. If the old oil is not removed when transformers are returned from the lines, an inspection should be made to see that the oil is up to the proper level. Schedules of transformers showing tank symbols and quantity of oil required for each line of transformers in service should be readily available. It should be noted that transformers of the same make and type but of different form may require quite different quantities of oil.

CLEANING OF TRANSFORMERS AND DETECTION OF FLAWS

The cleaning of the coils of transformers removed from the lines requires careful consideration, especially if they have been installed a considerable time and sludge has been precipitated by the oil. The elimination of oil deposits from the circulating ducts is particularly essential since their effects are cumulative. By impeding the oil circulation they cause the transformer to overheat with a given load, which in turn increases the sediment. An air-transil-oil spray is effective in flushing the ducts. When the oil is drained off it will also clear any moisture which may be present at the bottom of the case.

Many transformers cannot be properly cleaned without removing the coils from the case; this is especially true where the sediment has thickened. Some of the older types of transformers which have no oil ducts between coils should always be removed and cleaned by scraping, as a thick coating is generally to be found on the coils caused by the lack of circulation. Care must be used in scraping to avoid damaging the insulation. An air-distillate spray will be found effective for this kind of cleaning, but should not be used unless the transformer is dried out before being placed in service. A distillate spray should not be used within the test room, owing to the fire risk. A cast-iron grating with removable containers should be provided on the transformer platform for draining coils and cases; otherwise oil will be scattered about (Fig. 4). By this means considerable oil or distillate can be saved, as the oil can be filtered for re-use.

Cases should be examined for leaks. A crack in a cover may permit the entrance of sufficient moisture to

*Proceedings N. E. L. A., 1917, Technical and Hydroelectric Section, page 281. Also available in booklet form.

cause breakdown. Cast-iron cases when cracked may be welded with an oxy-acetylene torch; sheet-steel cases may be repaired by brazing or welding. Drain plugs should also be examined and set in with red lead if leaky. Felt strips should be carried in stock so that when those in service are lost or worn they may be replaced. It is important that these be kept effective.

Hanger irons and lugs should be examined for cracks and flaws. When transformers are returned from the lines it is advisable to arrange some system by which the hangers are kept with them or properly marked so that they cannot be mixed with others. If an improper hanger iron is shipped unnoticed with the transformer, it may cause an expensive delay to the line crew.

If a transformer has taps, connecting lugs, nuts and bars should be checked for missing parts. If they are missing, they will usually be found in the bottom of the case, where they were dropped while taps were being changed in the field. Spare connecting links should be taped to leads.

It should be ascertained that coils and core are firmly held in place by the bolts and wedges. To send a transformer out loose in the case will often result in damage to coils and consequent breakdown.

SCHEDULE OF CABLES TO USE IN RENEWING TRANSFORMER LEADS

Primary Leads					Secondary Leads					Secondary Leads				
Class	Transformer Size (Kva.)	Size of Lead	Insulation (1/64ths of In.)	No. of Strands	Class	Transformer Size (Kva.)	Size of Lead	Insulation (1/64ths of In.)	No. of Strands	Class	Transformer Size (Kva.)	Size of Lead	Insulation (1/64ths of In.)	No. of Strands
11,000-volt	1 to 100	6	16	7	460-230-115-volt	1 to 3	8	3	7	2300-460-volt	1 to 20	6	8	7
2,300-volt	1 to 5	12	8	7		5	6	4	7		25 and 30	4	8	7
	7½ and 10	10	8	7		7½ and 10	4	4	7		37½	2	8	19
	15 and 20	8	8	7		15	2	4	19		50	1-0	8	19
	25 and 30	6	8	7		20 and 25	1-0	5	19		75	2-0	8	37
	37½ and 50	4	8	7		30	2-0	5	37		100	4-0	8	37
	75	2	8	19		37½ and 50	4-0	5	37					
	100	1-0	8	19		75	190,900 c.m.	6	37					
						100	500,000 c.m.	6	61					

Testing for Burn-Outs

The most difficult of all repairs are those to coils. When a transformer comes in which is suspected of being burned out, unless it is evident from a superficial examination that the coils are completely ruined, tests should be applied with caution. A breakdown insulation test should never be applied until a megger is used. A premature insulation test may injure a transformer beyond repair. If the megger shows the insulation to be in bad condition, the transformer should be dried out by one of the usual methods and the test repeated. Such a dry-out will often correct the difficulty. Often a careful examination of the coils will reveal only a few damaged turns; these may be replaced or reinsulated if carefully handled. If necessary, all coils should be disconnected so that each may be "meggered" to the core separately. The megger test is of course a preliminary step only for the purpose of trouble location. No transformer should be reinstalled which cannot withstand an appropriate insulation test. Ratio, core loss and exciting-current determinations should also be made on each transformer before it is considered ready.

When it has finally been proved that a transformer is burned out it becomes necessary to decide upon its disposal. Several courses are open: It may be scrapped; it may be returned to the manufacturer on some exchange proposition; new coils may be wound in the local shop, or coils may be ordered from the manufacturer. In any case the decision will largely depend on the voltage class of the transformer, its age and type. Antiquated types having operating characteristics inferior to those of modern transformers should seldom be rewound. Transformers of the 2300-volt class can usually be returned to manufacturers for credit on a basis that is more economical than rewinding. On the other hand, it pays to order new factory-made coils for the higher-voltage classes. If a factory repair shop is available within reasonable distance, it may be cheaper to have the factory make complete repairs. When the coils are installed in a local shop, care must be taken to shellac and dry them thoroughly. Some form of drying oven should be available, and the transformer should be placed therein at a temperature of about 85 deg. C. (185 deg. Fahr.) for at least twenty-four hours.

Transformers should be stored in such a manner that they will be easily accessible. If platforms rather than racks are used, ample aisles should be provided between rows to avoid breakage of bushings (Fig. 3). Transformers of similar ratings should be grouped together. Burned-out transformers awaiting disposition should not be mixed with the others, and to eliminate any chance of their being taken out by a repair crew in an emergency they should be given a dash of colored paint or otherwise conspicuously marked.

Some recording system should be adopted in order that transformers returned from the lines shall be assured of proper attention and that no transformer shall be taken out until it is inspected and repaired if necessary. The three-part linen tag (Fig. 2) has been successfully used by one company for this purpose. Upon arrival the yard foreman issues a tag for each transformer. The lowest section is torn off and sent to the shop as a notification of work to be done; the remainder is attached to the transformer. When inspection, repairs and test are completed the middle section is torn off and sent to the record department as a notification of work done, and also that the transformer may be again placed on the active list. The upper portion of the tag remains attached to the transformer until it is reinstalled. The condition of each tag shows at all times the status of the transformer to which it is attached, and regardless of the method pursued in ordering out transformers for use, no transformer will be taken which has not received attention.

Liberty Is in Peril—Will You Lend?

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PREVENTION OF SLEET ACCUMULATION ON LINES

The Operation of Conductors at High-Current Density Serves to Melt Sleet—Unloaded Lines Are Heated by Wattless Current

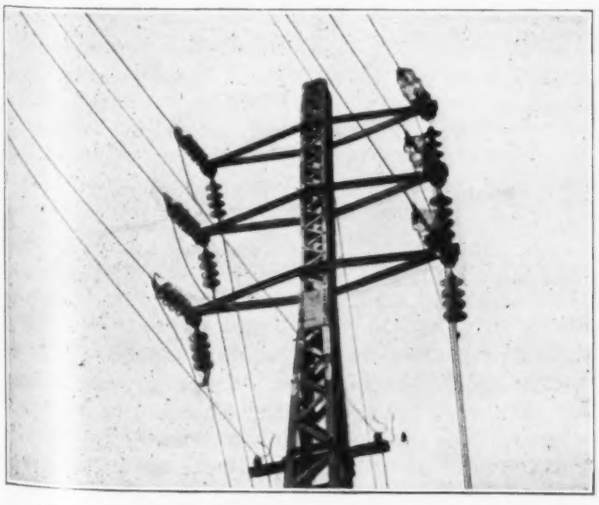
One company in the East has adopted the practice of circulating enough current through its lines during sleet storms to melt any sleet which may adhere to the conductors. Experiments show that about 250 amp. to 300 amp. is sufficient to keep sleet from sticking to 300,000-circ. mil aluminum cables. If ice has already been deposited, considerably more current may be required. Of course, 1 amp. per 1000 circ. mils is maintained only during storms. When the load is light all of the energy is transmitted over one line (duplicate lines being provided), so the conductors in that circuit will be heated sufficiently to melt the ice. The other is connected therewith at the delivery end and a wattless current forced through the cables by the reserve generators.

Lend or Pay Higher Taxes, Which?

HORN GAPS PROVIDED ON TELEPHONE LINES

Used at Frequent Intervals Where Communication Circuit Parallels High-Tension Transmission Line

To relieve the stresses on telephone lines paralleling its high-tension transmission lines a Southern company installs horn gaps between the communication circuits



TELEPHONE LINE PARALLELING POWER LINE EQUIPPED WITH HORN GAPS

and ground at frequent intervals. With this construction numerous "safety valves" are offered to high-voltage surges which may be induced in the lines, so there will not be the tendency to break down insulators. Furthermore, damage to telephone equipment and hazard to persons using it are thus reduced. This additional equipment is relatively inexpensive as the towers are grounded anyway and the horn gaps are easily installed.

Lend Freely for Liberty's Sake

CONDENSER RATING NECESSARY TO IMPROVE POWER FACTOR

Method of Using Chart to Determine Rating of Synchronous Condenser Required to Raise Power Factor to Any Value

BY H. H. GETTER

Many times in connection with industrial applications or when correcting distribution conditions it is desirable to have some quick method of determining the synchronous-condenser rating necessary to bring the power factor up to some higher value. The accompanying chart gives this information.

Since most synchronous motors are not designed to carry their total kva. rating in reactive power the chart is intended to give the particular kva. rating of condenser which will change the power factor to any value and also carry 71 per cent of its kva. rating in power load. It is assumed that the power load placed on it is taken off the motors formerly used; in other words, that the synchronous motor is used to replace some of the motors producing the low power factor. In this connection it must also be pointed out that it is assumed that replacing part of the induction motors by synchronous motors will not change the power factor of the remaining induction motor load. The scales on the chart may be multiplied by ten or any multiple thereof if both are similarly multiplied.

To show how this chart is used, suppose the load is 500 kva. at 50 per cent power factor and that it is desirable to increase the power factor to 95 per cent. Follow the 500-kva. (5 kva. $\times$ 100) circle to the point *a* where it intersects the 50 per cent power-factor line. then drop vertically to the 95 per cent power-factor line. Directly below is the actual kw. load (250 = 2.5 kw. $\times$ 100). The diagonal distance *de* laid off on the kva. scale indicates the rating (200 kva. = 2 kv. $\times$ 100) of the synchronous condenser which will correct the power factor and also carry a part of the original power load equal to kva. 71 per cent of its rating. The power load it can be made to assume is equal to the projection of *de* on the kw. scale, or 125 kw. (1.25 $\times$ 100). This leaves 125 kw. to be carried by the induction motors.

As another example of the use of the chart assume that there is a 500-kva. load at 50 per cent power factor and that 250 kw. more load must be carried. By using a synchronous motor to best advantage—*i.e.*, by making the wattless load equal to the power load—how

much can the power factor be improved and what will condenser rating be?

On the vertical line extending from the intersection of the 500-kva. (5 kva. × 100) circle with the 50 per cent power-factor line lay off with dividers a distance *ag* equal to 250 kw. Point *g* will fall on the radial line indicating the power factor that will be obtained, 80 per cent. The rating of the condenser required to carry the 250-kw. load and raise the power factor from 50 per cent to 80 per cent will be found by laying off the length of the diagonal line extending from 250 kw. on the horizontal scale to the vertical one through 0 on the kva. scale; in other words, 350 kva.

Where replacing part of the induction motors would change the power factor of the induction-motor load the wattless power necessary to improve the power factor can be determined by scaling the vertical distance

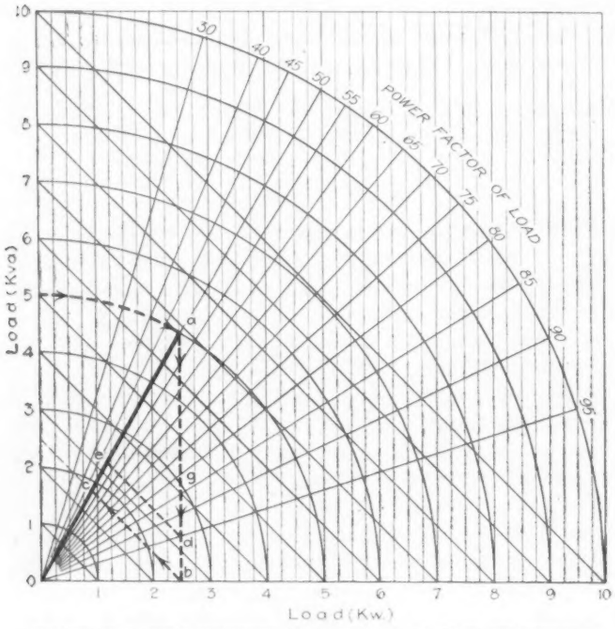


CHART FOR DETERMINING CONDENSER RATING NECESSARY FOR CORRECTING POWER FACTOR

between the improved power-factor line and the intersection of the kva. circle and the original power-factor line.

A Bond for Freedom's Cause

PREVENTING ICE STICKING TO THE TURBINE RUNNERS

Heating Metal Parts Slightly Above Freezing May Avoid Trouble—Deep Forebays Are Also Found of Benefit for This Purpose

To prevent ice from sticking to the screens, gates and turbine runners it is necessary to keep them at a temperature slightly above freezing. To do this effectively the metal parts must be heated before the gates are opened, for if a coating of ice once forms it will be much more difficult to prevent its building up. Steam, hot-water or electric coils can be placed in contact with the affected part, the metal of the turbine casing and shaft being used to conduct the heat to the surfaces exposed to water. No figures can be given on the amount of heat which will be required, as two similar plants taking water from the same source have been known to be affected differently.

In the opinion of one turbine manufacturer, a large deep reservoir very close to the turbines will prevent to a great extent the adherence of ice to runners. The greatest trouble occurs where the canal or river is very long and shallow and where there is no pond or reservoir to bring the water to rest and allow it to warm slightly before entering the turbines. The arrangement of penstock intakes also has some effect on the amount of anchor ice which will form. If the ice can be deflected from the opening, the trouble may be reduced.

Bonds—Uncle Sam's or the Kaiser's?

ITEMIZED COST OF LINE CONSTRUCTION

Data Apply to 35,000-Volt Two-Circuit Line Built Under War Conditions—Based on the Prices Current in 1917

In the accompanying table are given the itemized expenses of building 12 miles (19.3 km.) of two-circuit, 35,000-volt transmission line from Attleboro, Mass., to East Providence. The transmission line, consisting of two No. 00 three-phase circuits of bare copper wire, is erected on 40-ft. (12.2-m.) class "A" chestnut poles, set at intervals of 42 per mile (26 per km.). The cross-arms, which are of hard pine, are 10 ft. 6 in. (3.2 m.) long. Thomas' No. 2118 insulators, supported on Lee No. 9007 pins, are employed. Crossings over streets and other wires are protected by Thomas line-wire protectors. While the line is built to transmit 20,000 kw. at 35,000 volts, it will be operated for the present at a load of 5000 kw. and 22,000 volts.

The estimated cost per mile, including material and labor (exclusive of right-of-way), of the two-circuit overhead 22,000-volt line is $6,396.12, as set forth in the accompanying table of statistics based upon the prices of 1917.

COST PER MILE OF TWO-CIRCUIT, 22,000-VOLT TRANSMISSION LINE IN NEW ENGLAND

Kind and Size	Quantity	Unit	Price per Unit	Total Cost of Material	Cost of Labor
40-ft. chestnut poles	42	Pole	$10.00	$420.00	$126.00
H. D. standard bare No. 00 copper	13,000	Lb.	0.335	4,355.00	150.00
Tie wire, No. 4 solid	530	Lb.	0.36	190.80	....
No. 6 arms	50	Arm	1.75	87.50	25.00
No. 7 arms	50	Arm	1.75	87.50	25.00
Thomas insulators, No. 2118	300	In.	0.85	255.00	....
Strain insulators, No. 506	120	In.	0.154	18.48	....
Lee pin, No. 9007	300	Pin	0.43	129.00	....
Line-wire protector	36	Protector	6.44	231.84	....
Line hardware	....	....	....	20.00	....
Anchor rods and cones	60	Rod and cone	1.25	75.00	....
Cartage	....	....	....	150.00	....
Freight	....	....	....	50.00	....
Total	....	....	....	$6,070.12	$326.00
Total material and labor					$6,396.12

DESIRABLE CHARACTERISTICS AND FUNCTIONS OF CUT-OUTS

Various Types of Transformer Cut-Outs Are Considered from the Viewpoint of Their Suitability to 2200-Volt to 6600-Volt Circuits

In order to be satisfactory for operation on circuits operating at potentials between 2200 volts and 6600 volts a transformer cut-out must have the following characteristics, said C. A. Harrington of the Mahoning & Shenango Railway & Light Company recently:

1. When operated manually there should be no danger of flash, burn or shock to the lineman. This requirement applies also when re-fusing or re-closing the circuit after an interruption of service.
2. The automatic opening of the circuit in case of overload should be positive and reliable, and should occur while the current is within a few per cent of the rating.
3. The rupturing capacity as well as the current-carrying capacity should be stated by the manufacturer. The rupturing capacity should be several times the normal carrying capacity and the cut-out should break an arc of this magnitude without serious damage to itself.
4. There should be an external and clearly discernible indication of the condition of the cut-out so that it will not be necessary to open the circuit to determine whether the fuse has blown or not.
5. It should be possible to re-fuse the cut-out easily and quickly, even under adverse weather conditions, such as rain or snow.
6. First cost and maintenance cost should be moderate as compared with the value of the equipment protected.

Applying the foregoing tests to existing types of fuses shows that some are not perfect and that the manufacturers have much to accomplish yet. From the standpoint of safety, Mr. Harrington said, it is not safe to open any existing cut out like a disconnecting switch at more than a very small fraction of its rated carrying capacity. As to reliability of calibration, probably those types using specially formed links are best. The use of ordinary lead fuse wire may be sufficiently accurate, however, in the general case. The oil-immersed fuse type of cut-out is about the only type to which manufacturers will give a definite rupturing rating. This type can rupture at least ten times the rated current, they claim.

Expulsion cartridge-fuse type cut-outs have the advantage of giving an indication when they blow, and this indication can be made visible from the ground. Filled cartridge fuses and expulsion fuses inclosed in blocks of insulating material give indications which can be seen on close inspection and without opening the circuit. The common porcelain-plug type cut-out and the oil-fuse type give no indication, Mr. Harrington said.

The re-fusing of practically all types can be made a simple matter if spare removable parts are kept on hand which can be fused on the ground or in the shop. The work on the pole is thus reduced to a minimum, but the troubleman is obliged to carry more apparatus about with him.

The common porcelain-plug type of cut-out of course has the lowest first cost and the lowest maintenance. It is inexpensive even for the smallest sizes of transformers. Next comes the expulsion type having a ribbon fuse within insulating blocks. The cartridge type cut-outs follow, while the oil-immersed type is most expensive of all. The maintenance expense on this latter type is also the highest.

Bonds Speak Louder than Words

SUBSTITUTES FOR COAL AND OIL BEING TRIED

"Hogged Fuel," Pulverized Coal and Natural Gas Are Now Being Used by Pacific Coast Companies in Standby Plants

The high price of California fuel oil and the difficulty of getting coal under present conditions of rail and water transportation facilities has made the Pacific Coast power producers turn to water power. However, all along the coast there was less than normal precipitation in the early part of the winter, and the packed snow or ice in the mountains is less than usual. There will therefore probably be a shortage of stored water in the late summer.

In southern California natural gas is being used to some extent. One company (San Joaquin Light & Power) is building a 26½-mile (43.4-km.) 6-in. (15.2-cm.) pipe to bring in the gas. Central California companies have applications before the Railroad Commission for permission to raise rates, to enable them to meet the expense of coal or oil in auxiliary stations.

In Washington the promising substitute is pulverized coal. The Puget Sound Traction, Light & Power Company has done more pioneer work on this than any other company.

In Oregon the preferred substitute has been "hogged fuel," the material which used to be sent to the refuse burner, but now in increasing quantity is being run through a grinder known as a "hog," which cuts it up into small chunks. This is usually mixed with sawdust, shavings and small chips as they come from the mill machines.

The hogged fuel is sold in "units" of 200 cu. ft. (5.7 cu. m.). A "unit" weighs about 2 tons, fresh from the mill, and is calculated as the equivalent of two barrels of fuel oil, or say 400 kw.-hr.

The Portland Railway, Light & Power Company is trying the experiment of storing hogged fuel in piles to be used during the low-water period of late summer, thereby reducing the use of fuel oil. Two piles, in which 30,000 units are to be stored, are expected to develop, roughly, 12,000,000 kw.-hr.

Formerly refuse burners were maintained by the lumber mills at considerable expense to destroy the large quantities of waste produced. Therefore the use of this waste as fuel not only conserves coal and oil, but also saves the cost of its destruction. As it is bulky material to handle, the power plants are usually placed close to the mills, where conveyors can deliver the fuel direct to the boiler-feed chutes.

The Northwestern Electric Company of Portland is building a steam standby plant adjoining a sawmill which has entered into a contract to supply hogged fuel at a price that would be about the same as fuel oil at 27 cents per barrel. The first unit, now en route, is for 9380 kw. and capacity is to be increased later. In addition to generating electricity, the plant will supply steam to the company's steam-heating system in Portland, delivering 180,000 lb. to 200,000 lb. (81,647 kg. to 90,718 kg.) of steam per hour at 250 lb. (17.6 kg. per sq. cm.) to the main supply line.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

POWER SHORTAGE AFFECTS ELECTRIC RANGE POLICY

Western Property Now Allows But $20 on Installation Cost, Besides Cutting Down Installment Period from Twelve to Four Months

The plan under which the Pacific Gas & Electric Company of San Francisco formerly sold electric ranges called for 10 per cent cash and the remainder in twelve monthly payments. The company paid the installation cost, which was figured to amount to $50, and this amount was allowed on all ranges installed on the company's lines whether sold by the company or by outside agencies. If the customer desired to pay cash for the range, a discount of 10 per cent was allowed.

Since the power situation in California has grown acute through the increase in the price of oil, abnormally low stored water supply and rapidly increasing demand for power, the range policy has been revised so that it will no longer be a burden to the commercial department. The present plan is to sell at manufacturers' list less $20 per range, which is deducted as an allowance on cost of connection; the average installation cost is about $50, or $60 including water heater. The terms of payment are 25 per cent cash and the remainder in three monthly payments. If the customer desires to pay cash, a 5 per cent discount is allowed. The connection allowance of $20 is made only if the range is sold by the company.

The rates remain the same as before (averaging slightly less than 4 cents per kilowatt-hour), and the same service to consumers will be continued. Under the new plan the cost to the consumer will be greater, but it is hoped that the electric range department will be self-sustaining.

Do Your Fair Share—Buy Bonds

EXODUS OF SERVANTS BRINGS BIG APPLIANCE BUSINESS

When New York Manufacturing Concern Took Labor from Homes an Immediate Demand Arose for Labor-Saving Devices

A very interesting evidence of the influence of the domestic-servant problem on the market for electrical appliances was seen last month in Elmira in an experience of the Elmira, Water, Light & Railroad Company. One of the chief local manufacturing concerns lost a large number of young men at about the same time that considerable additional labor was needed in its plant. Much of this labor was required for the operation of automatic machines and for performing other tasks suitable for women. As the local demands on labor have been very heavy for the last two years, there seemed to be small chance of securing men for these jobs. The firm therefore advertised for 600 girls, giving its appeal a patriotic touch and making a particular effort to secure women who had been in domestic service. There was an immediate response, and a general exodus from the kitchen followed, with the result that hundreds of Elmira families found themselves servantless and compelled to adjust their household methods to the situation.

The Elmira Water, Light & Railroad Company has been actively advertising and selling household appliances for years and has been featuring the electric-servant idea. The influence of this effort was immediately seen, for inquiries began to pile in and there has been an almost continuous demonstration of washing machines, vacuum cleaners and other labor-saving household appliances in the company's salesroom ever since. So acute has been the crisis that the husbands as well as the wives have been taking an active hand in seeking out this household machinery, and a great many of the demonstrations and sales have been made to men. A large amount of business has resulted and the demand continues.

Liberty Bonds Are Safe and Sure

THE SALES MANAGER'S SITUATION IN WAR TIME

Analysis of Tactics of Different Men Confronted with Problem of Reducing Sales Forces for Economical Reasons

The sales manager of a manufacturing company recently made a circuit of a number of important central-station cities in the West and Middle West. In discussing with his firm the impressions gained on the trip he laid special emphasis on the different manner in which different central-station commercial men had met the recent announcements of their superiors that the commercial department would "have to stand a cut."

In his analysis of the tactics of these men under fire he divided them into two classes—first, those who accepted the order unquestioningly and proceeded to discharge their men; second, those who looked at the proposition squarely and met their superiors with an array of sound facts to show the folly of absolutely eliminating commercial work. He had seen and talked to men in both classes and knew how they handled their jobs. His observations and opinions should be of interest and of value to central-station sales managers as presenting an outside viewpoint. The following are approximately his words:

"As typical of those of the second class, take a man in the West who had been spending $112,000 annually in new-business operations. His profit on that expenditure was $98,000. In other words, it had actually been costing the company in cash expended $14,000 a year to acquire all of the load it added to its lines.

including in the term load all power, residence, range and appliance business. The edict was that that expenditure would have to be stopped because of the shortage of capital and because the company did not want to increase its peak materially. The plan proposed by the officers was to curtail the activities of the department by materially reducing the sales forces. But the sales manager demonstrated, first, that 40 per cent of the expense incident to operating the new-business department was not at all new-business expense but was expense incident to keeping existing customers satisfied and on the lines. He assumed, and it was granted, that the company wanted to retain its cordial relations with the public and to retain its existing load. This being true, it was evident that if the entire sales force was disposed of 40 per cent of the cost of running it would need to be expended somehow in order to maintain service. The sales manager contended, however, that the sales department as then organized could do this work better than any other agency. In addition to this he showed how he could by eliminating certain more or less gratuitous services reduce his expenses to $84,000 and how by extending the duration of certain intensified sales efforts he could increase his profits on sales to $120,000. He pointed out strongly that the financial stringency was within the company and certainly was not with the potential customers of the company, and that this could be turned to good account by intelligent solicitation of appliance and range business without greatly increasing the peak load of the central station.

"There was considerable doubt as to his ability to increase sales to the extent promised, but nevertheless permission was given to try out the plan. At the rate sales are being made now, the department will make $147,000 instead of $120,000 as promised. That gives an indication not only of how well the plan worked but also of the truth of the statement that the public has more money now to spend for electrical goods and service than it ever had before.

"That is the important point which has been all too easily overlooked in the cities where the sales forces were peremptorily discharged. Activities were stopped just at the time when the least effort was required to make sales. In such cities it is notable that the public relations of the central-station companies are none too desirable. This is traceable largely to the fact that the company has no commercial force with which to placate the complaining customer. With him a trivial grievance that could at one time have been glossed over with a jolly word has grown to a deep-rooted grudge that it will take years of effort to eradicate.

"Now, the big thought back of these two different methods of meeting a situation is that the one sales manager knows his job and the other is incompetent in certain respects. The one realizes that the sales manager's job is to advise accurately on commercial policy as well as to see that goods and services are sold. The other sees only that part of his duty which involves the actual selling. The former type of sales manager is certainly the more desirable, for even though he may be less expert at selling, he will get farther in the long run."

Join the Army of Bondholders

LONG INTERCITY HAUL WITH ELECTRIC TRUCK

Five-Ton Truck with Load Makes the Trip from New York to Baltimore Over Very Bad Roads and Arrives in Good Form

As a result of the abnormal conditions of rail transportation the use of trucks for intercity haul is receiving the support of government officials and trade generally. The electric truck is hardly considered as suitable for this type of service, but the accompanying data indicate that it can overcome the difficulties in the way.

A 5-ton truck consigned to the American Tobacco Company in Durham, N. C., by the General Vehicle Company was denied all shipping accommodations east of Washington, and it was found necessary to drive it over the road to Alexandria, Va., then ship it by boat and rail to its destination. As the embargo affected other merchandise also, the truck was loaded with seventy-five cases of tinfoil for a branch of the

ELECTRIC TRUCK EN ROUTE FROM NEW YORK TO BALTIMORE

tobacco company in Baltimore and made the 226-mile (363-km.) trip successfully late in March, notwithstanding the bad road conditions and poor charging facilities en route. After delivering its load the truck made the 38-mile (61-km.) run from Baltimore to Washington on one charge and in good running time.

The heavy traffic over the roads of New Jersey, Pennsylvania and Maryland at the present time has played havoc with the road surfaces in many sections of these States, and when a truck gets mired in a bad spot it frequently ties up scores of other trucks for hours. Some idea of the condition of these roads, particularly in Delaware and Maryland, may be gathered from the fact that this 5-ton truck, which on city streets requires a current of 9 amp. per mile, consumed 240 amp. in going 12 miles (19 km.) in Delaware, or 20 amp. per mile.

On its trip the truck encountered charging conditions anywhere from 90 volts to 140 volts and at from 10 amp. to 110 amp. The forty-four-cell, nineteen-plate battery had a rating of 298 amp., but 380 amp. was taken from the battery in one case and full charge in Baltimore took 420 amp. Neither motor nor battery, it is stated, was heated during the trip, though the current draw was excessive for hours at a time.

COMPARING GAS SERVICE AND ELECTRIC SERVICE

Aspects of the Competition Between the Two Commodities Analyzed by One Who Has Been Studying the Situation

In a paper presented before the Indiana Gas Association, C. N. Chubb, formerly manager of the South Bend district of the Northern Indiana Gas & Electric Company, tried to convince the gas men that they had electric competition in every line of their business.

He pointed out that in the electrical industry half a dozen large companies do national advertising, and that in the gas field no such work as this goes on to keep the consumers of public-utility service thinking about the gas company as they think about the electric company.

"In the lighting field," Mr. Chubb said, "the electric man has not only developed efficient lamps but has developed artistic fixtures and lighting effects. He has also made electric lighting convenient for use and easy to maintain, with the result that consumers are willing to pay more for electric service than for equivalent gas service. The convenience and easy-maintenance problems are the hardest for the gas man to meet in lighting." The same holds true in the small domestic-appliance field, the speaker said, lamenting particularly that the gas industry had not sooner appreciated the value of auxiliary outlets.

Speaking of cooking, he said that the electric range does not have to go through the educational period, for the public is ready to take up electric cooking just as soon as it can be convinced of the practicability of the electric range. The electric range is advocated as easy of operation and control by means of automatic heat regulators and time-limit devices, heatless and odorless because of good insulation, and economical owing to better efficiency. Easy control, said Mr. Chubb, is certainly an advantage which should be shared by the gas range. The speaker further pointed out that the electric range is more efficient than the gas range, and declared that gas-range manufacturers should build more efficient gas ranges even at a greater expense.

In his review of the industrial field Mr. Chubb said that the gas industry had been content to let its customers struggle along with inefficient apparatus until the various fields were invaded one by one by the electric companies. As the situation now exists, the gas industry stands to lose considerable industrial business which it might have retained by beginning earlier to develop efficient utilization apparatus.

Giving Wider Publicity to Federal Viewpoint on Utilities

On a pink folder which is 3 in. by 5 in. in dimensions the Commonwealth Edison Company of Chicago has mailed to its customers copies of the letters on the importance of public utilities recently exchanged between President Wilson and Secretary of the Treasury William G. McAdoo. This folder is being distributed to the customers of the company with the idea of giving more widespread publicity to the viewpoint of the federal government on the utilities as essential factors in the national welfare.

STOP FLAT-RATE SERVICE TO PREVENT ENERGY WASTE

Worcester Company Feels that Uncertainties of Fuel Situation Demand Utmost Economy in Use of Electricity

On April 1, 1918, the Worcester (Mass.) Electric Light Company discontinued flat-rate service on its system, about 900 customers going over to the metered basis. All of these were residence customers, the commercial flat-rate service to stores and other business establishments having been done away with several months before. Practically no complaint was received from the residence customers, whose monthly bills on the flat-rate plan ranged in general from $1 to $3. The company announced the change when it mailed its February bills, each bill carrying a 1¾-in. by 5½-in. yellow sticker as reproduced herewith.

To the local press representatives officials of the company explained that under the old flat-rate plan considerable energy was being wasted. War conditions demand the elimination of all unnecessary waste, and the anticipated uncertainties of the fuel situation later in the year require the utmost economy in the utilization of electricity. The company also wished to do away with the maintenance of current-limiting equipment used in connection with flat-rate installations. Then, too, a good deal of time and trouble had been experienced in connection with trips to homes to sign up new contracts for small increases in connected load. The time of year was favorable to the change, with a decreasing consumption of energy for lighting purposes. The flat rates were inaugurated about six years ago, when the company's residential lighting rate was about 12 cents per kilowatt-hour, while the present rate is 8 cents. The flat-rate plan was based on a charge of 1 cent per watt connected per month.

ALL FLAT-RATE CONTRACTS WILL BE DISCONTINUED APRIL 1, 1918

We will install a meter for you and charge you in future for our service at our regular lighting rates. Some meters will be installed before April 1 to enable us to complete all changes as near that date as possible. Should your meter be installed earlier we will gladly rebate any amount you may have paid in advance for your service.

Yours truly,
WORCESTER ELECTRIC LIGHT COMPANY
March 1, 1918 11 Foster Street

In order to make the change as easily as possible, customers were informed that if a meter should be installed during the month before the first of April customers desiring to go over to metered service then and there would be allowed to do so; but if any one wished to retain his flat-rate service until April 1, the reading of the meter on that date and not on the date of setting would mark the beginning of the new system of charging. In many cases the change to the metered rate was accepted on the spot, the public taking the company's explanation without objection. Data are not yet in hand as to the total effect of the change, but it is known that many customers' bills will be no larger under the metered rate than on the flat rate.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Replacing Direct-Current and 25-Cycle Alternating-Current Motors by 60-Cycle Designs in an Industrial Plant.—Operating results have shown that the total cost of the installation will be recovered in a few years through increased production and economies effected by standardizing motor drive and change in service arrangement to use three-phase, 60-cycle, 440-volt alternating-current motors and power purchased from a central-station company in replacing the original equipment, which consisted of steam and gas-engine-driven generating units, furnishing 125-volt direct-current and 25-cycle alternating current service to different parts of a plant.—*Electrical Record*, April, 1918.

Rotary Converters.—Self-starting two-phase and three-phase rotary converters are described and their wiring diagrams are shown.—*Southern Engineer*, April, 1918.

8750-Kva. Compounded De Laval Turbo-Generator at Vasteras.—The nickel-steel rotor is forged in one piece, the windings being held in place by long wedges. Provision is made for the inlet of ventilating currents below the windings. Illustrations accompany the description. —London *Engineering*, March 29, 1918.

Mechanical Design and Specification of Turbo-Alternator Rotors.—S. F. BARCLAY.—Stresses in the solid and laminated types of rotor are discussed. The desirability of high-tensile strength and cold working, also the relative mechanical and electrical features of nickel-chrome steel and solid forged carbon-steel rotors, are discussed.—London *Electrical Review*, March 29, 1918 (abstract of paper read before the Institution of Electrical Engineers).

Aluminum in Transformers.—Aluminum has been suggested as a substitute for copper in transformer windings. Dealing with heat dissipation, temperature rise, comparative costs of the different materials and other important factors, it appears that the advantages are still with copper.—London *Electrical Review*, March 29, 1918.

Armature Reactance of Polyphase Alternators.—F. S. NEWBURY.—Drop in voltage due to an increase in load is caused by three factors, viz., the resistance of the armature winding, the reactance of the armature winding and the armature demagnetization or reaction. These factors are discussed in reference to polyphase alternators, the article embodying several useful illustrations.—*Electric Journal*, April, 1918.

Lamps and Lighting

Electric Lighting of Ecclesiastical Buildings.—WILLIAM WILSON.—There are few tasks so difficult as that of providing suitable artificial lighting for a church or a cathedral, says the author. It involves the introduction of what is virtually a novelty into one of the most conservative situations in existence. The article deals with the special advantages of electricity for church lighting, the requirements to be met, electric fittings, and the general details pertaining to the subject.—*Journal of the Institution of Electrical Engineers*, March, 1918.

Incandescent Lamps.—H. W. MATEER.—Data relating to the different kinds of lamps, color quality of light and the effect of improvements are discussed in this article.—Toronto *Electrical News*, April 1, 1918.

Generation, Transmission and Distribution

Transmission-Line Practice.—LIEUT. E. T. DRIVER and E. V. PANNELL.—Sixth article on this subject, dealing with some high-voltage problems. Conductor spacing is the principal subject discussed.—Toronto *Electrical News*, April 1, 1918.

Electric Power Supply and Coal Conservation.—To improve transmission and distribution conditions in England the following plans are proposed: (1) the establishment of a central body of electricity commissioners; (2) the division of the country into districts; (3) the appointment of boards to control the generation and transmission in these districts, leaving the detailed distribution of electricity and sale of electrical energy more or less in the hands of existing authorities; (4) the installation of large power plants in order to obtain the maximum economy in capital outlay, efficiency in operation and diversity of demand; (5) the provision of extra high-tension mains which should interconnect the various stations.—London *Electrical Review*, March 22, 1918.

Double Overhung Francis Turbines.—ARNOLD PFAU. —The article deals with use of large single hydroelectric units, particularly the double overhung Francis turbine, which is used in the White Salmon River powerhouse.—*Journal of Electricity*, March 15, 1918.

Electrical System of the Rand Power Companies, with Special Reference to Methods of Operation and Experience.—BERNARD PRICE.—Use of cables in series with overhead line, running up rotary condensers, temperature rise of generators, cooling of transformers, steam governing, generator relays and use of generator transformers as coupling transformers are among the subjects discussed in this paper, which refers particularly to methods of operation.—*Transactions of the South African Institution of Electrical Engineers*, December, 1917.

Interconnection and New Power Development.—P. M. DOWNING.—There is an abundance of undeveloped hydroelectric power on the Pacific Coast, where it could be economically transmitted to markets, says the author, but it has been permitted to lie idle for no other reason than that capital could not be interested in its development. These projects are unattractive not because of physical or engineering reasons, but solely because their development and utilization are

unattractive financially.—*Journal of Electricity*, March 15, 1918.

Water Power in Bavaria.—Two companies have been formed in Bavaria for the purpose of developing the water powers of the kingdom, one on the upper Inn and the other on the middle Isar. One section of the latter—between Mossburg and the Danube—has been turned over to the Allgauer Elektrizitaets Gesellschaft, which is providing for about 70,000 hp.—*Journal du Four Electrique*, March 1, 1918.

Tamarack Mills Power Plant.—CHARLES H. BROMLEY.—The chief features of a new oil-burning plant furnishing light, heat and power to the Tamarack Mills, Pawtucket, R. I., are discussed. Some interesting performance figures are given.—*Power*, March 26, 1918.

Physical Data of a High-Voltage System.—H. A. BARRE.—The article deals with the Big Creek hydroelectric development and transmission system of the Southern California Edison Company, one of the most impressive systems of high-voltage transmission in existence. The article will be found of timely interest in these days of interconnection and hydroelectric conservation. Valuable data on high-tension design, standard anchor and angle tower construction, steel-cored aluminum cable, ground wires, insulators, routine tests, etc., are given. The specification details involved in this article are of especial value.—*Journal of Electricity*, March 15, 1918.

New Station of the Rochester Company.—P. B. FINDLEY.—The article deals with a 32,000-hp. hydroelectric generating station operated to carry the load peaks of the combined systems. It describes the location and general scheme of the station, the dam and gate construction and hydraulic and electrical features of the plant.—Chicago *Electrical Review*, March 23, 1918.

Traction

Locomotives for the St. Paul Railway.—F. H. SHEPARD.—The article deals with the construction of ten Baldwin-Westinghouse locomotives for the Chicago, Milwaukee & St. Paul Railway, gives a method of minimizing rheostatic losses, explains how three sources of supply can be provided for the auxiliaries, and outlines considerations favoring the twin-motor quill drive over other kinds of motors.—*Electric Railway Journal*, March 23, 1918.

Fast Service Line.—The system extends from Niagara Falls to Buffalo, operates at 600 volts and cost approximately $170,000 per mile. Features of the overhead construction and substations with cost data are set forth in this article.—Toronto *Electrical News*, April 1, 1918.

Savings Effected by Automatic Substations.—H. E. DAVIS.—Light-load losses are minimized by stopping the rotary converters during prolonged light loads. The automatic substation permits three-car trains to pass without overloading the machines. The article describes the New York State Railways (Utica-Syracuse lines) system, which purchases automatically controlled energy for its Manlius Center substation.—*Electric Railway Journal*, April 13, 1918.

Why the Automatic Substation Saves Materials and Labor.—CHARLES F. LLOYD.—Advantages and disadvantages of automatic substations are analyzed, the article describing details of equipment and referring to economies that can be effected.—*Electric Railway Journal*, April 13, 1918.

Installations, Systems and Appliances

Automatic Switching Equipment.—R. J. WENSLEY.—This article deals with the automatic operation of synchronous substations, taking up starting, polarity, synchronism, protective devices, etc.—*Electric Journal*, April, 1918.

Electrical Shoemaking.—G. BASIL BARHAM.—One of the first shoe factories in the world to be electrically equipped throughout is described.—London *Electrical Review*, March 8, 1918.

Overwinding and Controlling Devices for Winding Engines.—H. NEWBERY.—A discussion of the relative merits of the different types of winding engines that goes into detail of the conditions to be met and how they should be met.—*Transactions of the South African Institute of Electrical Engineers*, November, 1917.

Water Pumping by Electric Power.—R. L. YATES.—This is the continuation of an article which discusses the characteristics of motor-driven pumps and gives suggestions for selection of pumps for municipal water pumping. The author points out that economies in plant operation and efficiencies of the pumping equipment used do not necessarily parallel each other. The efficiencies of reciprocating pumps are, as a general rule, in excess of the efficiencies to be obtained by the use of centrifugal pumps. The comparative efficiencies of triplex and centrifugal pumps operating under the best conditions and for capacities up to 1500 gal. (5678 l.) per minute are discussed.—Chicago *Electrical Review*, March 23, 1918.

Warrior River Steam Plant of Alabama Company.—W. B. WEST.—Brief description of a stand-by steam station for taking care of emergency loads. One 25,000-kw. turbo-generator unit is installed, but additional units are to be provided. Coal is obtained from a mine only a few hundred feet distant. Details of the layout and other interesting features are given.—*Power*, March 19, 1918.

Wood, Steel and Concrete Pole-Line Costs.—F. L. HAUSHALTER.—The comparative costs of treated and untreated wood poles are discussed in this article, which is a continuation of an article in the April 6 issue.—Chicago *Electrical Review*, April 13, 1918.

Practical Alternating-Current Engineering Problems.—W. R. BOWKER.—Different methods of interconnecting rotary converters and transformers, also their operating characteristics, are discussed. The article embodies several circuit diagrams.—New York *Electrical Engineering*, April, 1918.

Standardization of Pin-Type Insulators.—L. M. KLAUBER and R. E. CUNNINGHAM.—The standardization of supplies and the consequent cost reduction, improved service and economies resulting therefrom are described in this article.—*Journal of Electricity*, April 1, 1918.

Wires, Wiring and Conduits

Mechanical Working of Underground Cables.—CHARLES F. STREET.—The mechanical strength of the hauling tackle and also of cable, including a determination of the force required to draw cables of varying dimensions into different classes of ducts, the ability of

a lead-covered, air-spaced and paper-core cable to withstand a tensile force without injury and the relative properties of lead and an alloy of lead and tin as a sheathing material, are discussed.—*Telephone Engineer*, April, 1918.

Electrophysics and Magnetism

Simplest Hardening Equipment for Carbon Steel.—At a certain temperature, called the temperature of recalescence, carbon steels become non-magnetic. The temperature at which this condition occurs is also the temperature at which carbon steels should be quenched in order to obtain the finest grain and most desirable mechanical properties in the hardening metal. Thus, in order to obtain an indication of the best temperature for quenching, it is only necessary to have an indication of when the steel becomes non-magnetic. A description and an illustration of the furnace embodying this principle are given in the article.—London *Electricity*, March 22, 1918.

Electromagnetic Induction and Relative Motion.—S. J. BARNETT.—A paper was presented before the American Association for Advancement of Science on this subject in which the author considers a short-circuited parallel-plate air condenser in a magnetic field parallel to its plates. If the condenser is moved parallel to the plates but at right angles to the induction, certain conditions will exist, whereas others will exist if the condenser is held stationary and the agent producing the magnetic induction is moved parallel to the plates but at right angles to the induction. A very complete discussion is given of the results observed that may clear up hazy ideas regarding the generation of electromotive forces by motion of conductors in a magnetic flux.

Units, Measurements and Instruments

Measurement of Permeability.—FRANK SHAW.—Permeability is influenced by the layer of scale formed on mild steel during the process of rolling. A number of experiments are described that were conducted to determine the permeability of laminated specimens of steel by the Ewing double bar and yoke method.—London *Electrician*, March 22, 1918.

Telegraphy, Telephony and Signals

New Swedish Radio Station.—At Karlsborg, Sweden, a wireless station has been completed which is capable of sending messages over a distance of 3150 miles (5000 km.). The masts, weighing only 25 tons each, are 684 ft. (210 m.) high. They are insulated at four different places from base to top and are erected with the bases embedded in black granite blocks, impregnated with paraffin. The antennas are 1476 ft. (450 m.) long and composed of sixty phosphor-bronze wires hung from steel tubes. The capacity of the station is increased by covering the territory between the masts with a phosphor-bronze wire netting.—*Schweizerische Bauzeitung*, Feb. 9, 1918.

Inclosed Arc with Novel Characteristics.—The device consists of a low-expansion glass envelope such as a sodium-magnesium boro-silicate glass. The cathode consists of a high refractory material such as tungsten, tantalum or carbon. The anode is made up of metallic calcium, magnesium, titanium or other metal highly reactive chemically to gases other than the inert so-called rare or monatomic gases. Certain chemical effects and electrical effects are dealt with in the article.—*Wireless Age*, March, 1918.

Transmission Efficiencies of Cord Circuits.—WALTER C. FREEMAN.—The efficiencies of different kinds of cord in operation upon different kinds of circuits are discussed. The article is illustrated with circuit diagrams.—*Telephone Engineer*, April, 1918.

Loading Coils Versus Repeaters.—W. N. FURTHMANN.—Properly designed and correctly installed loading coils are adequate for all long-distance work, says the author. The reasons for arriving at this conclusion are embodied in the article.—*Telephone Engineer*, April, 1918.

Miscellaneous

Combustion Characteristics of Coal and the Selection of Suitable Stoker Equipment.—JOSEPH WORKER.—Many factors that enter into the success or failure of equipment selected for various kinds of coal are discussed. The article is well illustrated and contains considerable data on the various effects of coal and also on the performance of various kinds of stokers.—*Electric Journal*, April, 1918.

New Insulating Material.—A new composition proposed as a substitute for porcelain, marble, slate and vulcanized fiber, etc., consists of 52 per cent pulverized asbestos, 14 per cent of sifted mica, 20 per cent mineral caoutchouc, 10 per cent rubber solution, 3 per cent of sulphur and 1 per cent of resin. It is claimed that the finished material is hard and nearly fireproof, and that it can be molded, machined and wrought.—London *Electricity*, March 22, 1918.

Water Power in Great Britain.—ALEXANDER NEWLANDS.—Data relating to the rainfall, river discharge, ratio of ordinary to flood discharge, catchment areas, horsepower available, etc., in the British Isles, with references to many available sources of information on these points, are embodied in this article, which is an abstract of a paper read before the Royal Society of Arts.—London *Electrical Review*, Feb. 8, 1918.

New Views of the Combustion of the Volatile Matter in Coal.—S. H. KATZ.—The volatilization of the hydrocarbons in coal and the burning of the volatile matter in the combustion space of the furnace are discussed in the following order: (1) physical influences of the chemistry of volatilization of coal matter; (2) primary products of distillation; (3) mechanism of the combustion of hydrocarbons, which includes the speed of the reaction, with a table giving the cracking effect of temperature on oil at atmospheric pressure, and finally the hydrocarbon equilibrium in coal fires.—*Technical Paper* 183, Department of the Interior, Washington, D. C., 1918.

Description of the Works of White's South African Cement Company, Ltd.—H. CAMPBELL.—The article gives interesting details in connection with the power plant and certain statistics pertaining to the laboratory, repair shops, limestone quarry, ropeway, wet mill, mixer, kiln plant, coal plant, cement mills, silos, etc.—*Journal of the South African Institution of Engineers*, January, 1918.

Fuel-Oil Burners.—J. F. SPRINGER.—Essentials of the two principal methods of burning oils and details of the equipment are described.—*Southern Engineer*, April, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ENERGY SUPPLY FOR MUNITION FACTORIES

President Joseph B. McCall Says that Philadelphia Electric Company Furnishes More for War Industries than Any Other Utility

Reporting concerning the operations of the last year, Joseph B. McCall, president Philadelphia Electric Company, says that stockholders will be interested in knowing that the company, in addition to supplying the general needs of the communities served, is now furnishing more energy to munition factories and other war industries than any other utility in the United States and is second in supplying transportation.

"The electrical energy for all additional transportation requirements for Hog Island and other points supplied by the Philadelphia Rapid Transit Company and the additional electrification of the Chestnut Hill branch of the Pennsylvania Railroad are furnished by this company," says Mr. McCall.

A "WINNING THE WAR" N. E. L. A. CONVENTION

President Lieb Calls Attention to the Fact that the Atlantic City Meeting Will Be Devoted Entirely to War Problems

President John W. Lieb of the National Electric Light Association has sent the following notice to members:

The thirty-fourth annual meeting of the National Electric Light Association and its forty-first convention, to be held at the Hotel Traymore, Atlantic City, June 13 and 14, 1918, will be devoted entirely to problems of the war.

This will be a strictly business meeting, without entertainment of any kind. It will concern itself entirely with the vital problems of the industry arising out of the war, toward the winning of which the thoughts and energies of every public utility must be consecrated.

No papers will be read. Reports from committees and individuals and discussions will be confined to matters of major importance, and the brief two days will allow no time for the usual helpful discussions on general topics relating to the progress of the art. Everything said and done must be keyed to a victorious conclusion, and an early one, of the great struggle on which our nation has entered and in which our industry is taking a part of continually growing importance.

There will obviously be a reduced attendance, far below the numbers in pre-war years. Naturally, member companies, large and small, will endeavor to be represented by at least one of their officers or executives; and others in attendance would preferably be selected from among those dealing directly with the member company's activities affecting war work or civilian co-operation with the national government.

Our industry, increasingly a permeating factor in the national life, is now subjected to abnormal strains on its personnel and resources. It is the desire at such a vital juncture to devote the time and energies of the association and of those at the convention to only one enterprise which now counts—winning the war.

LIGHTLESS ORDER SUSPENDED BY FUEL ADMINISTRATION

Dr. Garfield Withdraws Restrictive Regulations Until Sept. 1 at the Urgent Request of the Liberty Loan Committee

United States Fuel Administrator Garfield sent to all state fuel administrators on April 22 an order suspending until Sept. 1 the so-called lightless night order which went into effect last November, when extraordinary street and sign lighting was prohibited on Thursday and Sunday nights of each week. The order is:

"At the urgent request of the Liberty loan committee I have decided to suspend operation of the lightless night order beginning next Thursday night. [The lightless order was therefore suspended beginning April 25. —Eds.] By reason of the late hour of lighting brought about by the daylight saving law the lightless night order will remain suspended until Sept. 1 next, when it will again become effective."

Reports to Washington say the restrictions throughout the country on lighting, etc., have been modified by the state fuel administrators from time to time as weather conditions changed. Many of the modifications have been of purely local interest and have been dealt with in detail by the various state administrators.

Aiding the Sale of Liberty Bonds Electrically

During the Liberty loan campaign at Chicago a unique method of acquainting riders in automobiles with the progress of the local drive was worked out. A space on a North Side boulevard was marked off to represent Chicago's quota of bonds. As the sales force progressed with the sale a ball was moved over this marked section by an interval representing the number of thousands of dollars' worth of bonds sold. The ball was electrically lighted at night.

MEETING IN NEW YORK ON PUBLIC UTILITY CONDITIONS

Conference Held by the Committee with Advisory Committee Representing Electric, Gas and Electric Railway Properties

A meeting of the National Committee on Public Utility Conditions was held in New York on April 18. It was called for a conference with the advisory committee. The National Committee on Public Utility Conditions is composed of P. H. Gadsden, E. K. Hall and H. H. Crowell.

The advisory committee consists of:

Representatives from National Electric Light Association—J. W. Lieb, New York Edison Company; Joseph B. McCall, Philadelphia Electric Company; Henry L. Doherty, Cities Service Company, New York.

Representatives from American Gas Institute and National Commercial Gas Association—Randal Morgan, United Gas Improvement Company, Philadelphia; A. P. Lathrop, American Light & Traction Company, New York; M. B. Daly, Eastern Ohio Gas Company, Cleveland.

Representatives from American Electric Railway Association—T. N. McCarter, Public Service Corporation, Newark, N. J.; L. S. Storrs, Connecticut Company, New Haven, Conn.; A. W. Brady, Union Traction Company of Indiana, Anderson, Ind.

Mr. Lieb has been elected temporary chairman of the advisory committee and T. C. Martin temporary secretary.

The National Committee on Public Utility Conditions is the committee which presented recently the facts showing increased costs of operation and the need of higher rates to officials of the Treasury Department, through whom they were referred to President Wilson.

This committee, composed of representatives of electric, gas and electric railway properties, will represent the utilities associations on matters common to the entire industries. It is not the intention to handle matters affecting individual companies.

Employees of New York Companies Doing Their Share

Between 600 and 700 employees of the New York Edison Company in the Bronx district and of the Yonkers Electric Light & Power Company held a Liberty loan rally at 140th Street and Rider Avenue on April 22. Frank W. Smith, vice-chairman of the committee carrying on a campaign for bond subscriptions among the employees of the Consolidated Gas and affiliated gas and electric companies, presided. Addresses were made and the orchestra of New York Edison Company employees rendered several patriotic selections. The audience sang the "Liberty Anthem." Although 80 per cent of the audience had already subscribed, $5,000 more was turned in. This brought the total subscriptions in the affiliated companies to $870,000, with 11,607 employees out of 14,265 subscribing.

Congress to Consider Further Taxation Soon

Representative Kitchin, chairman of the House ways and means committee, during a debate in the House of Representatives, announced that Congress must soon consider whether further taxes are to be imposed.

Employees of Large Electrical Manufacturing Companies Helping to Win the War by Buying the Liberty Bonds

AT SCHENECTADY WORKS OF THE GENERAL ELECTRIC COMPANY

AT EAST PITTSBURGH WORKS OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

LARGE TOTAL OF BUSINESS OF GENERAL ELECTRIC COMPANY

Electrical and Mechanical Orders in 1917 Reach $246,700,000 and Sales Billed Aggregate $196,900,000 in the Year

"In the year 1917 the volume of your company's business far exceeded that of any previous year," is the modest statement of C. A. Coffin, chairman of the board of the General Electric Company, in the annual report to stockholders. Values of orders received, compared with preceding years, were:

	Electrical and Mechanical	War Munitions	Total
1917	$246,778,491	.....	$246,778,491
1916	167,169,058	$2,416,000	169,585,058
1915	98,385,891	33,980,000	132,365,891
1914	83,748,521	.....	83,748,521
1913	111,819,142	.....	111,819,142

The value of electrical and mechanical orders received last year increased 47.6 per cent over 1916 and 150.8 per cent over 1915.

Sales billed, $196,926,318, increased 47 per cent over the previous year. Earnings compare as follows:

	Year Ended Dec. 31—		
	1917	1916	1915
Sales billed	$196,926,318	$134,242,289	$85,522,070
Less: Cost of goods billed, including all operating, maintenance and depreciation charges	167,921,778	118,948,198	76,898,183
Balance	$29,004,540	$15,294,091	$8,623,887
Interest and discount	$1,433,317	$1,539,499	$1,434,269
Income from securities owned	2,661,150	1,844,645	1,554,843
Sundry revenues	417,822	482,738	694,996
	$4,512,289	$3,866,882	$3,684,108
Total	33,516,829	19,160,973	12,307,995
Less: Interest on debentures	571,645	571,445	570,085
Interest and discount on notes payable	541,356	.....	.....
	$1,113,001	$571,445	$570,085
Balance	$32,403,828	$18,589,528	$11,737,910
Less excess profits tax estimated	5,500,000	.....	.....
Available for dividends	$26,903,828	$18,589,528	$11,737,910
Dividends paid	*11,165,882	8,121,646	8,129,918
Net surplus for the year	$15,737,946	$10,467,882	$3,607,992
Previous surplus	34,160,753	23,692,871	20,084,879
Surplus	$49,898,699	$34,160,753	$23,692,871

*Includes 8 per cent cash, 1 per cent cash "Red Cross" and 2 per cent stock.

Mr. Coffin says in part in the report:

A substantial portion of the large increase for the past year consisted of orders for ship propulsion and other apparatus placed by and for the United States government, but the increase extended to nearly every line of the company's product. Higher prices, due to increased cost of material and labor, were also a factor in the larger total value of orders.

The large increase in sales during the last two years has made it necessary to add to manufacturing facilities to an extent entirely without precedent. During the year $22,320,895 was expended for land, buildings and other structures, tools, machinery and smaller equipment and fixtures. In view of the prevailing high prices of all material and other unusual conditions, the sum of $13,287,249 has been charged against income and general reserve as depreciation and additional plant reserves, resulting in a net increase, in the book value of plant and equipment, of $9,033,646.

Although previous reports to the stockholders have only shown the net book value of the plant account, it has been the company's practice for years to maintain a record of the cost of property investments, confirmed by a careful appraisal. The difference between the gross and net book values has been carried on the general ledger in a "general plant reserve." It is now deemed desirable to set forth both items in the published report.

The large increase in the volume of orders naturally involved corresponding increases in merchandise inventories and in customers' notes and accounts receivable.

After deducting reserves which are regarded as ample the merchandise in factories, district warehouses and elsewhere is shown at a net book value of $81,851,310, an increase of $30,690,671 for the year.

Customers' notes and accounts receivable, after deducting adequate reserves, are carried at a net book value of $38,406,993, which is $11,590,695 more than the balance outstanding at the close of 1916.

The additional capital absorbed in plant extensions, inventories and customers' accounts amounted to $77,602,262, in order to provide for which in part the company issued short-term notes during the year, the balance outstanding at Dec. 31 being: Issue of July 2, 1917, three-year 6 per cent notes, $15,000,000; issue of Dec. 1, 1917, two-year 6 per cent notes, $10,000,000; temporary notes, maturing in February and May, 1918, $2,757,721; total, $27,757,721.

It is expected that with the return of normal business conditions sufficient cash will be released by a reduction in inventories and customers' notes and accounts to provide for the two note issues aggregating $25,000,000.

The federal taxes for 1917, including the income tax at 6 per cent, $1,789,508, which was absorbed in cost of sales, and the estimated excess profits tax of $5,500,000, will amount to $7,289,508.

On May 8, 1917, Anson W. Burchard, vice-president, was elected a director of the company.

The board of directors desires once more to testify to its deep appreciation of the admirable response of the employees in all departments to the demands made by the difficult and pressing problems of the past year.

Mr. Coffin then takes up the increase in capital stock. None had been made since 1912, and in the meanwhile the growth of the business had been:

	1917	1912
Orders received	$246,778,491	$102,934,788
Sales billed	196,926,318	89,182,185
Net income (after all taxes) applicable to interest and dividends	28,016,830	13,110,823
Total surplus (after payment of interest and dividends), represented by investments in manufacturing facilities, working capital and other assets	49,898,699	12,031,145

On Jan. 3, 1918, stockholders voted to increase the authorized stock from $105,000,000 to $125,000,000, and they have since been given the right to subscribe at par for one share for each ten shares held. On Nov. 24, 1917, directors declared a semi-annual dividend of 2 per cent, payable in stock.

"This action was taken," says Mr. Coffin, "in view of the large surplus from accumulated earnings covering a period of years, invested in manufacturing facilities, working capital and other assets, against which no stock had been issued. Your directors preferred, rather than to increase the rate of cash dividends, to adopt the policy of paying semi-annual stock dividends at the rate of 4 per cent per annum, payable in January and July, in addition to the regular 8 per cent cash dividends."

Total factory floor space in 1917 was 17,573,000 sq. ft., as compared with 15,300,000 sq. ft. in 1916.

Book value of the manufacturing plants on Jan. 31, 1893, was $3,958,528. In the twenty-four years ended Dec. 31, 1916, additional expenditures of $88,634,909

were made, and in 1917 $22,320,895 was added, making an aggregate of $114,914,332. During the twenty-five years there was written off or carried to "general plant reserve" $75,975,922, leaving the book value of all plants as of Dec. 31, 1917, at $38,938,410.

In addition to the $22,320,895 expended last year it has been necessary to authorize $13,000,000 for further plant extensions, which will be completed during 1918.

The balance sheet as of Dec. 31, 1917, sets forth manufacturing plant, including land, buildings and machinery, at $77,028,908, which, less the general plant reserve of $38,090,498, leaves net $38,938,410. Real estate, buildings, warehouses, etc., other than manufacturing plants, stood at $794,210. Stocks, bonds and other securities were listed at $37,348,608. Cash on hand was $21,190,675. Current liabilities were $18,150,025.

Speaking further of the balance-sheet changes, Mr. Coffin says:

For a number of years it has been the practice of the directors to provide against contingencies by setting aside substantial reserves. An examination of these reserves makes it clear that a proportion of them is unlikely to be used for the purpose originally intended, and such proportion, estimated at about $12,000,000, has therefore been set apart and shown as a general reserve against all assets of the company other than its plant investment.

In past years it has been the company's practice to state its patent account at $1, but a record has been maintained showing the serial number, date and cost of these patents. That proportion of the cost which represents the unexpired life of the patents, viz., $3,097,444, is carried as an investment on the company's books, being offset by a reserve of like amount, and both accounts are now shown in full.

Details of the changes in the plant account were:

	Gross Book Value	General Plant Reserve	Net Book Value
Real estate and buildings	$40,533,721	$15,061,826	$25,471,895
Machinery	31,274,744	17,808,232	13,466,512
Patterns	1,991,110	1,991,109	1
Furniture and fixtures	3,229,331	3,229,330	1
Total	$77,028,908	$38,090,498	$38,938,410

Give Liberty to the World

LIGHTING QUESTION FROM THE USER'S POINT OF VIEW

Electrical Engineer for Marshall Field & Company, Chicago, Tells of Effect of Light on Volume of Sales of Merchandise and on Factory Production

Frederick J. Pearson, electrical and mechanical engineer for Marshall Field & Company, Chicago, speaking before the Illuminating Engineering Society, Chicago Section, presented facts and conclusions regarding the use of light in the company's retail, wholesale and manufacturing establishments. Light intensity, he said, has a decided bearing on the rapidity with which retail merchandise moves. If time were available, actual data could be prepared from the records of the store to show that increasing the intensity of light beyond what is ordinarily considered a normal value increases the sale of goods in certain departments. The more intense light reacts on customers and salespeople alike. It intensifies the customer's desire to buy and increases the enthusiasm of the sales person. This does not hold true in all departments, however. It would obviously be foolish to try such a plan in the Oriental goods department. There is, of course, a limit to the intensity that can be used with profit, but this intensity, the speaker thought, will approach daylight intensities more closely as the quality of the light is improved. The better quality of the gas-filled lamps in some measure helps to make possible the present high intensities used in the store. There is much less complaint now from lighting with 7 ft.-candles, 8 ft.-candles and 9 ft.-candles than there was with intensities 50 per cent as great before the advent of gas-filled lamps. Mr. Pearson expressed a firm belief that lighting should be designed for sales efficiency or production efficiency rather than lighting efficiency. He urged a thorough study of the conditions and a design based on the conditions rather than a study of installations already made and a copy of them.

Speaking of factory production in its relation to lighting, Mr. Pearson stated that he had been able to increase factory output as much as 10 per cent by the application of adequate lighting. The intensities used in the factories, of course, depend on the work. The average intensity for general lighting in Marshall Field's plants is from 6 ft.-candles to 7 ft.-candles, with special localized lighting as high as 15 ft.-candles.

The speaker's comment on lighting equipment, given altogether from the viewpoint of the user, was not altogether flattering. He dwelt at considerable length on the inadequacy of showcase lamps and lighting equipment, but stated that it is impossible to do without showcase lighting. He declined to comment on a trial installation which he had made to test many forms of daylight equipment. He expressed the general view that adequate lighting could most easily be secured by a scheme of general illumination supplemented by localized lighting.

How Hydroelectric Energy Saves Coal

Here is a 55,000-kw., 110,000/13,200-volt and 55,000/13,000-volt substation which materially reduces the amount of coal that must be hauled long distances into the great producing centers of the Northwest. It is "Terminal A" of the Minneapolis General Electric Company, which receives at Minneapolis hydroelectric energy from Taylor Falls, 40 miles distant, and from Wissota, 90 miles distant. Working at 50 per cent load factor, it will relieve Minneapolis industries from burning 360,000 tons of coal per year.

For a Free World—Buy Bonds

Our Boys Go—Shall Money Fail?

STUDY OF ECONOMY FOR THE PUBLIC UTILITIES

Addis Whitney of Boston Appointed by Commercial Economy Board of the Council of National Defense

The commercial economy board of the Council of National Defense has arranged with Addis Whitney of Boston to go to Washington in the near future to make a study and a report on opportunities in conservation among the public utilities of the country as a war measure. The board, of which A. W. Shaw of Chicago is chairman, has been instrumental in bringing about various economies in different industries, notably among department stores and laundries, eliminating overlapping deliveries, returning goods sent on approval and in similar ways.

Mr. Whitney has made a preliminary visit to Washington for conferences with officials. It is expected that two or three weeks will be required for his study, which, Mr. Shaw states, will take in possibilities of conservation in the use of capital and material.

He Also Fights Who Buys

DELAY IN WAR FINANCING AFFECTS PUBLIC UTILITIES

Washington Authorities Hear That Need of Prompt Action Is Urgent, but Liberty Loan Campaign Causes Delay

The delay in the organization of the War Finance Corporation, the enabling act for which was recently signed by President Wilson, is, according to reports reaching Washington, seriously affecting a number of large public utilities which have to finance maturities on the first of May. Public utilities in various sections of the country whose officials had looked forward to an early organization of the corporation and had expected that relief in finance would be afforded before this may not be able to obtain the necessary result under the act of Congress until after the present Liberty loan campaign is ended on May 6, when the Secretary of the Treasury will have returned to Washington and be able to take up with the President the subject of organization and appointing directors.

Reports reaching Washington show that between $15,000,000 and $20,000,000 in public utility securities will in all likelihood go by default on May 1, when they mature, unless, in the absence of the Secretary of the Treasury, there is assistance from unexpected governmental sources. Newspaper dispatches show that in at least one city, Pittsburgh, a receivership has been applied for, and there are reports in Washington of other possible difficulties.

The conditions, it is stated in Washington, point to the urgent necessity of the speedy organization of the War Finance Corporation, so that the investing public as well as the public utility management may feel that governmental machinery able and willing under proper conditions to come to the relief of the public utility industries has been set up.

There are no indications in Washington yet as to who will be appointed directors in the War Finance Corporation. It is believed that the matter will not be taken up at the White House until the return of Secretary McAdoo from his Liberty loan tour.

Will You Lend for Human Freedom?

WAR SERVICE OF THE WIRE AND CABLE MAKERS

Le Roy Clark Will Act Hereafter as a Government Representative Instead of as Representative of the Manufacturers

At a dinner-meeting of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies at the Yale Club, New York, on the evening of April 18, the conditions under which co-operation is being developed with the government on war orders were reviewed carefully.

Since the original formation of the wire and cable committee to give the fullest measure of service to the government, several changes have been made, which

LE ROY CLARK

were really in the nature of evolution to meet the necessities of the different government departments as they enlarged from time to time. Thus, the committee became a committee of the General War Service Committee of the Electrical Manufacturing Industry, and as such it represents all of the wire and cable manufacturers, without regard to whether they are or are not association members.

The latest change arises from the fact that Le Roy Clark, president Safety Insulated Wire & Cable Company, who has been the chairman of the wire and cable committee from its inception, has been made a member of the War Industries Board, serving as chief of the wire and cable section of the finished products division.

It was explained at the meeting on April 18 that Mr. Clark, as a result of this appointment, resigns as chairman and as a member of the committee. He, however, will continue to do exactly the same work of allocating government orders, though he will do so now as a government representative instead of as a representative of the manufacturers.

To take the place of Mr. Clark as a member of the

committee, George B. North, Hazard Manufacturing Company, was elected. The committee will elect a chairman later. The organization of the committee will be fully maintained, and it will be used to strengthen the co-operation between the government and the manufacturers.

Everett Morss, president Simplex Wire & Cable Company, a member of the priorities committee of the Council of National Defense, spoke at the meeting of the reorganization of the War Industries Board and emphasized how necessary it is that every manufacturer shall take all of the government work that he can handle in order to meet war necessities as promptly as possible.

A. W. Berresford, Cutler-Hammer Manufacturing Company, recently elected president of the Associated Manufacturers of Electrical Supplies, spoke of the effective work of the Wire and Cable Section for the government.

An interesting report was made by the freight committee.

In connection with the meeting the members of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies elected officers as follows: Chairman, Le Roy Clark; secretary, J. Nelson Shreve, Electric Cable Company; treasurer, Edward Sawyer, Atlantic Insulated Wire & Cable Company.

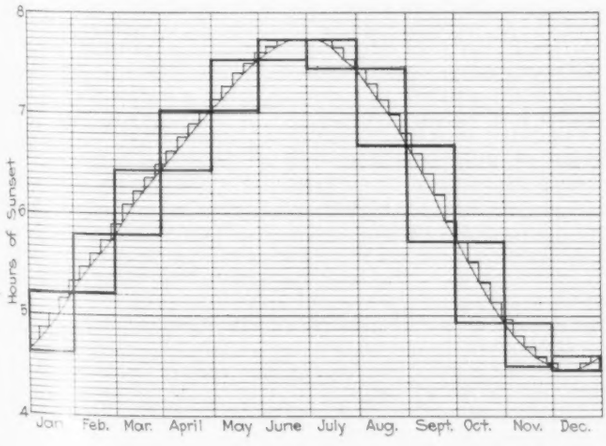
Back the Bayonets with Bonds

EFFECT OF THE CHANGE TO DAYLIGHT SAVING

William H. Winslow Shows Results of New Plan in Superior, Wis.—Regular Progression of Hour of Sunset

William H. Winslow, vice president and general manager Superior (Wis.) Water, Light & Power Company, has made diagrams showing the results of daylight saving which are reproduced herewith.

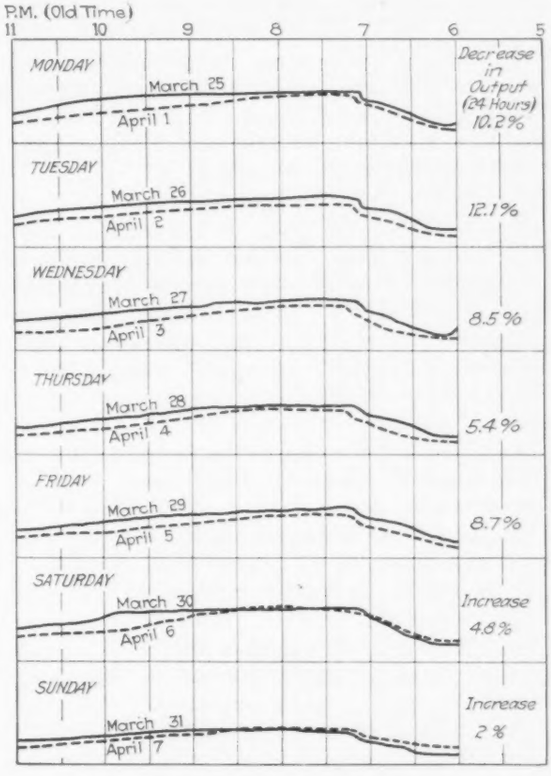
One chart shows a comparison of the total station load of that company between 6 and 11 p. m., standard



PROGRESSION AND RETROGRESSION OF SUNSET HOUR

time, or 7 to 12 p. m. as the clocks are now set, for the first week in April, compared with the same days of the week seven days earlier.

It will be noticed that all of the curves except those for Saturday and Sunday show a decrease throughout which is comparatively slight to about 8.30 (9.30 new time), when it increases quite rapidly. The business of the company is very largely residential, such sales being almost equal to the commercial sales for lighting, and Mr. Winslow attributes the falling off in the load between 6 and 8.30 (old time) to the fact that there is now practically no duplication such as existed prior to April 1, when living-room lights would be turned on



BEFORE AND AFTER DAYLIGHT SAVING

before those in dining rooms, whereas now there is no light required until after the usual hour for the evening meal.

"The reason why the curves for Saturday and Sunday show no falling off until late in the evening and why the total outputs show an increase is that on these days in April we had a severe storm," Mr. Winslow says, "so that it was dark much earlier than usual. Of course, the first Sunday shown on the chart was supposed to be the beginning of the daylight-saving period, but it did not seem to be fully observed, so that I have used it in preference to going back another week."

The other chart brings out the fact, not perhaps generally appreciated, that during the first half of the year the progression of the hour of sunset is much more regular than is its retrogression during the second half of the year. The vertical height of each of the parallelograms shows the difference between the hour of sunset at the beginning and close of the month. It will be noted that the three months of August, September and October show a greater shortening of the days than the lengthening during the four months of February, March, April and May. The hours of sunset used are those given for this altitude in the World Almanac.

"I made this chart in connection with a study of the probable effect of daylight saving," adds Mr. Winslow, "but it is also useful in explaining to customers the rapid increase in their lighting bills during the fall months."

Buy for Liberty—Invest in Bonds

CONFERENCE ON WAR PROBLEMS BY SOUTHWESTERN ASSOCIATION

Rates and Labor Shortage, with High Cost of Operation, Discussed at Meeting at Dallas, Tex. — W. A. Sullivan Elected President

War conditions were largely responsible for a falling off in attendance at the fourteenth annual convention of the Southwestern Electrical and Gas Association, which closed its session at Galveston, Tex., on April 17. The following officers were elected:

W. A. Sullivan, vice-president and general manager Shreveport Railway Company, president; Burr Martin, general manager Texas Electric Railway, Dallas, first vice-president; E. S. Fletcher, general superintendent Texas Power & Light Company, Dallas, second vice-president; A. Hardgrave, chief operating engineer Southwestern Utilities Company, Dallas, third vice-president, and J. B. Walker, treasurer. H. S. Cooper was elected executive secretary by the newly elected executive committee, making the seventh consecutive time for him to be chosen for this office.

The convention was opened on April 15 with President H. C. Morris, Dallas, presiding. The welcoming address was delivered by Mayor I. H. Kempner and the response by W. B. Head, vice-president Texas Power & Light Company.

Edward F. Harris of Galveston delivered a patriotic address on "War Savings, a Solution of Our National Problem."

Lynton T. Block, president Employers' Indemnity Insurance Association of St. Louis, spoke on "Jovian Insurance."

Address of President Morris

"Since our last convention so many changes have occurred affecting the public utilities of various kinds comprised within this association that I found it difficult to decide where to begin," said President Morris in his annual address. He continued:

The first and most vital matter is the ratio between operating expenses and gross income, because that ratio must be in favor of the gross earnings to an extent to provide a reasonable return on our investment in our properties or we are potentially bankrupt, for the reason that one of our liabilities is the necessity of continually giving our customers a 100 per cent local service, and we are compelled to cut our service in either quantity or quality.

The most surprising condition which has come upon many of us within the last year is that while our gross receipts have largely increased, our operating expenses have increased in so much greater proportion that in almost every case our profits have decreased. As a matter of law we are compelled to take on under prescribed conditions any new business offered us in normal times, but the times are so abnormal that we are often compelled to protect customers by refusing new business which causes any expenditure for extensions, enlargements or increases.

One of the benefits of this condition is that it has compelled us, and still is compelling us, to investigate thoroughly our ability to saturate more completely the territory covered by our lines.

The ability of the private concerns to raise the prices of their products or services in proportion to the rise in the price of labor and materials used in manufacturing gave them an elasticity in financing which was denied the public utility, whose prices for its product or service were fixed and which had not the power or the ability to increase them as its operating expenses increased.

The public has never been so educated that it has actually realized that the local utility, with few exceptions, is fully as dependent on ordinary business and commercial laws as is the local flour mill, cotton gin, furniture factory or any other local manufacturing or distributing business.

While present conditions have increased our operation expenses in almost every line and in every department of our business, the two most important things that we have to consider at this moment are labor and fuel. I have put labor first because all the rest of our business is dependent on it. Labor is the personal, human element which, when everything is fully reckoned up, makes us or mars us. We can accumulate a surplus of fuel, we can use a less economical or less efficient fuel, but we can do neither without labor. Under the peculiar conditions now confronting us, the "labor market" is so depleted that we cannot get the desired number of laborers. We not only have to make the best of what we have, but the prospects are that even this "best" may be further depleted in the near future. We have the experience of England and France to guide us, and this experience of theirs has shown only two methods of meeting the emergency. One of these is using a different character or class of labor from any ever used before. The other is making the present labor more efficient by supplementing it with labor-saving machinery. It is probable that we may have to do both.

With the proper and increasing objection to child labor, there is left as the single alternative the use of woman labor. England and France are not alone in the use of woman labor. Our own East and Middle West are employing women in work which twelve months ago would have been given to men only. We of the South and Southwest have certain traditions with respect to the employment of women in positions necessitating hard manual labor of great publicity which will make it difficult immediately to follow the example set in other portions of the country; but we may soon be compelled to follow their example.

We of the utility business are behind other manufacturing and distributing plants in the use of labor-saving machinery. With the sole exception of firing our boilers we have been plodding along with the same proportion of labor to our output as we have for years past. It is true that we have greatly increased the size of our generating, transmitting and distributing units, and have thus indirectly decreased the proportion of labor to output. That has been in most cases a resultant not fully considered in the investment, because the reason has been to obtain greater efficiency and economy in our apparatus. If by the expenditure of $500 we make a net saving of only 10 cents per day in labor we have made an annual saving of $36.50 per year, which is over 7¼ per cent on the investment. This is almost as good as a Liberty bond and nearly as patriotic, for we have released nearly $40 worth of actually useless labor, and as badly as the government needs labor at this time every cent's worth wasted is a crime.

The question of fuel in Texas is a complicated matter, because we have four fuels locally available, coal, lignite, natural gas and oil. The distances in the State are so great that freight and pipe lines costs are a large factor. The necessities of the national government are such at this time that not only have the mine prices been raised on coal but freight rates in some cases have also been advanced. It seems probable that the use of oil as fuel may be still further restricted in the future to an extent which will make it too costly or too uncertain for the use of public utilities.

There has come at least one bright spot in the gloom surrounding the public utilities at this time, and that is the recognition which they have received at the hands of the government. No one can read the letters of our President and our Secretary of the Treasury or the reports of the Comptroller of the Currency and feel that our efforts have not been fully appreciated.

At the second day's session reports were made by H. S. Cooper, secretary of the executive committee.

Discussions on "What Are Many of Us Going to Be Compelled to Do on the Fuel Question?" and "A Safe

Method of Public Procedure When Increasing Operating Expense Necessitates Increase of Rates" filled the morning session on April 16. These were followed by a discussion on the possibility of using lignite for fuel. Fuel questions were brought up again at the afternoon session.

STUDY OF LIGNITE PROPOSED

Secretary Cooper displayed a geological map of Texas, in which locations of lignite beds were shown. These were found to be near the largest public utility plants. Mr. Cooper said that the deposits would be useless unless steps were taken to make the fuel easier to handle. He said that North Dakota has spent considerable money in looking into the possibilities of its lignite operations and that lignite is being stored in that State.

It was decided to consider sending two young men to the University of Texas to take a special course in geology for the purpose of endeavoring to find a solution for the fuel problem through lignite beds. H. C. Morris, Dallas, said that students of the University of Michigan and Cornell University are now studying the lignite problem with the hope that they may find a way in which the product may be used for fuel. These students are receiving geological instruction at the expense of public utility concerns.

The question of increasing rates was discussed by nearly every one in attendance. The prevailing opinion was that eventually rates must be raised because of the increased costs of labor and fuel. J. C. Kennedy of Brenham reported that some concerns have increased their rates without receiving complaints from the public.

Others maintained that in nearly every instance the public probably would complain if rates are increased, but that the public must be educated to the fact that it may be necessary to increase the rates on account of conditions being abnormal. Several expressed confidence that the public would not complain if reasonable increases in rates are made, and all delegates declared that no excessive profits should be made during the war. Every delegate declared that his company is endeavoring to give the best service possible and that consumers in general are pleased with the service.

A. Hardgrave, Dallas, said that no company should expect to increase rates except in cases of necessity. Several said that the companies should take up the matter of increasing rates with the city officials before making increases. Fred P. Brien, Amarillo, said that each company should have its employees become familiar with conditions and that by working out this plan the employees would tell the public of the conditions.

Secretary Cooper said that in any event the rates should be made equitable. "It may not be so much a matter of increasing rates as it may be of revising rates," he declared.

The question of obtaining sufficient labor during the war also was discussed. Delegates said that they were making the best of conditions under the circumstances, but all of the companies have lost considerable numbers of capable employees on account of the draft. Some companies are training men who are not subject to draft.

R. W. Van Valkenburgh, Dallas, general manager of the Texas Western Electric Company of Texas, read a paper on "Suggestions for Conservation in Purchasing from the Seller's Standpoint." The paper contained numerous suggestions that might be used by the sellers and pointed out the necessity of conservation. The paper was followed by discussions on the subject.

Build for the Future—Buy Bonds

COMMISSIONS SHOULD HAVE POWER TO INCREASE RATES

Commissioner Whitney of New York Says that Policy Must Assure Development and Improvement at All Times

Commissioner Travis H. Whitney of the New York Public Service Commission, First District, describes the attitude of the commission as a recognition of the need for a close continuous scrutiny of the public utility corporations and for a rate that will "yield operating expenses, depreciation and obsolescence and a moderate return on the actual value of the property." This appears in a statement prepared by Mr. Whitney concerning the commission's administrative, judicial and legislative functions.

It is stated that when operating expenses are lowered through a decline in wages, costs or otherwise there is reason for reducing the rates charged the public, but when the reverse condition prevails the commission should have the power to increase rates.

Commissioner Whitney says further:

> The commission must see that the public gets what it pays for. That task requires the constant supervision of all phases of public utility service. The basis of the right of a public utility to charge a reasonable rate and earn a reasonable return is the furnishing of adequate service, and the duty of the commission is to determine what service shall be rendered and the rate to be paid for that service.
>
> The commission must see to it that the public pays for what it gets. The commission ought to be at all times in a position to see to it that the rates are such as to represent payment by the public for what it gets, no less and no more. If the company is to be at all times denied the right to earn more than a fair return when operating costs are falling, it cannot be left to earn less when costs are mounting.
>
> The commission must see to it that the policy pursued by it and by other public authorities is such as to assure at all times the development and improvement of public utility enterprises. It must also see that the conditions surrounding public utilities are such as to encourage new utilities where and when needed, and generally to attract the necessary capital to enable the upkeep of the properties and service at suitable efficiency.
>
> Capital can be drawn to public utilities from private enterprises only by establishing an attractive relationship between the certainty of return and the percentage of return the utility is allowed to earn upon the money of investors.

It is also shown by Mr. Whitney that if capital is deterred from embarking in public utility enterprises the public suffers.

The Legislature will be asked to amend the public service commissions law so that the commissions will have authority to raise rates as well as to reduce them.

End the Spy System—Buy Bonds

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Synchronous Club of Los Angeles.—The annual banquet of this club was held in Los Angeles on April 18.

A. S. M. E., Providence Section.—The power division of the Providence Section of the American Society of Mechanical Engineers will hold a discussion on "Thermal-Insulation Covering" on May 9.

A. I. E. E., Madison Section.—On April 16 G. E. Wagner talked on "Three-Phase, Four-Wire Distribution" before the Madison (Wis.) Section of the American Institute of Electrical Engineers.

A. S. M. E., Los Angeles Section.—"Power Sources and Distribution in California" will be discussed at the meeting of the Los Angeles Section of the American Society of Mechanical Engineers in May.

New York Electrical Credit Association.—On Tuesday evening, April 30, the New York Electrical Credit Association will hold its regular annual meeting at the Building Trades Club, 30 West Thirty-third Street, New York.

A. I. E. E., Cleveland Section.—"Storage Batteries in War" was the subject of a talk delivered by M. R. Berry, president Electric Products Company, before the Cleveland Section of the American Institute of Electrical Engineers on April 22.

Electrical League of Cleveland.—Major Ross C. Cockburn of Toronto, Canada, a veteran of Canada's Expeditionary Forces, gave an interesting address entitled "The First Canadian Contingent" before the Electrical League of Cleveland on April 18.

A. I. E. E., Seattle Section.—F. Lindsay presented a paper on "Recent Additions to the Generating Equipment of the Puget Sound Traction, Light & Power Company" on April 16 before the Seattle Section of the American Institute of Electrical Engineers.

A. I. and S. E. E. Inter-Section Meeting.—The Pittsburgh and Cleveland Sections of the Association of Iron and Steel Electrical Engineers will hold a joint session at Youngstown, Ohio, on May 18. A special trip will be made to the McDonald and Ohio works of the Carnegie Steel Company.

A. I. and S. E. E., Philadelphia Section.—On May 4 the Philadelphia Section of the Association of Iron and Steel Electrical Engineers will hold a meeting at the Majestic Hotel, at which H. A. Lewis and W. H. Burr will present a paper on "Electrically Operated Door Hoists for Open Hearths and Furnaces." Major William A. Garret will address the meeting on "Some of My Observations in France."

Western Society of Engineers.—"Storage of Bituminous Coal" was the topic of a paper read by H. H. Stoek, professor of mining engineering, University of Illinois, before the Western Society of Engineers at Chicago, April 15.

A. I. and S. E. E. Section Meeting.—T. F. Baily, president of the Electric Furnace Company, is to read a paper on "Electric Soaking Pits, Annealing and Heat-Treating Furnaces and Furnaces for Melting Non-Ferrous Metals" before the Cleveland Section of the Association of Iron and Steel Electrical Engineers on April 27.

A. S. M. E., New York Section.—"Labor Turnover" will be the subject of a discussion at the May 21 meeting of the New York Section of the American Society of Mechanical Engineers. The subject will be presented by Captain Boyd Fisher of the War Industries Board at Washington and G. R. Woods of the Allied Machinery Company.

Electric Club-Jovian League.—The Electric Club-Jovian League of Chicago has recently listened to two war addresses. Rufus C. Dawes gave some amazing figures on the cost of the war and on the sums of money expended by the United States. Alexander Reichmann spoke on April 18 on "Reflections on the War, Its Consequences and Problems."

A. I. E. E., Schenectady Section.—"Modern Transformers" was the subject of an illustrated address delivered by J. J. Franks of the engineering department of the General Electric Company before the Schenectady Section of the American Institute of Electrical Engineers on April 19. The design of both large and small transformers was discussed.

Jovian League, Atlanta, Ga.—A chapter of the Jovian League has been formed in Atlanta that will include Jovian and non-Jovian members. It will be made up strictly of those in the electrical industry. The membership will be limited to fifty during the first six or eight months, and the object will be of a promotional character both for electrical and civil purposes. C. D. Cabiness, Western Electric Company, has been chosen as the first president, and C. A. Collier, Georgia Railway & Power Company, secretary-treasurer.

Ohio Electric Light Association, New-Business Meeting.—The industrial power and heating section of the new-business committee of the Ohio Electric Light Association will hold a meeting at the Electrical League clubrooms, Statler Hotel, Cleveland, on May 8. Papers to be presented are: "Present Status of the Electric Brass Furnace," by H. M. St. John, research engineer, Commonwealth Edison Company, with discussion by E. F. Collins, Schenectady, N. Y., and T. F. Bailey, Electric Furnace Company, Alliance, Ohio; "Silent Chain Drives Used in the Application of Electric Motors," by Paul V. Wheeler, Cleveland; "War-Time Economies," by W. A. Wolls, Columbus Railway, Light & Power Company, Columbus, Ohio.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability for Injury on Private Premises.—Where plaintiff's injuries resulted from electric wires of defendant city left lying on private premises, the city's liability depends on whether plaintiff was a trespasser or had a legal right to be on the premises, according to the Court of Appeals of Kentucky (200 S. W. 931).

Condemnation Denied Where Acquisition Will Not Accomplish Object.—Where another company has condemned part of land intended by a water company to be a part of its project, proceedings by the latter to condemn the remaining part will be dismissed where the acquisition of such lands could not accomplish its object, as shown by its filed maps and plans, the Supreme Court of New York held in Ramapo Mountains Water Power & Service Company vs. Seidler (168 N. Y. S. 737).

Contract to Furnish Energy.—Where complainant had paid for electric light to be furnished for three years pursuant to a contract an injunction will issue to prevent cutting off the light or to compel a public utility company which had turned the current off to turn it on again, the Supreme Court of Arkansas held (200 S. W. 799). A contract by an electric company to furnish a consumer free energy for three years upon being released from a previous contract to furnish energy for a share of the consumer's earnings was held not invalid because discriminatory in a case where the franchise from the city did not appear to prohibit such contracts.

Franchises Free from State Control.—While the state may authorize municipalities to grant a franchise to a public service corporation free from the exercise of the state's power of regulation, such franchises are never construed to have that effect unless the state's grant of authority and the municipality's grant in the franchise are clear and positive, according to the Supreme Court of Indiana (118 N. E. 531). A state may ratify a franchise granted by a municipality which excepts the grantee of the franchise from the exercise of the state's power of regulation, even though the municipality had no authority so to exempt at the time of granting the franchise. The act of 1867, as amended in 1891, giving the common council of a city exclusive power over the streets, highways, alleys and bridges within the city did not authorize the city to grant a franchise to a public service corporation free from the state's police power to regulate.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Fuel Administration and Utility Ownership Problems.—A letter from Dr. H. A. Garfield, the federal Fuel Administrator, has been made public by representatives of the United Improvement Association of Los Angeles, Cal. That association sent recently to the federal Fuel Administration a copy of a letter in which the association urged the city council of Los Angeles to take action to conserve the city's power rights. "You may rest assured," says Administrator Garfield, "that the Fuel Administration will do nothing under the guise of conservation that would cause injustice to the people of Los Angeles, and that the State of California must determine for itself whether municipal ownership or private control shall be the future policy in its regulation of public utilities."

Electric Storage Battery Earnings.—The annual statement of the Electric Storage Battery Company, Philadelphia, for the year ended Dec. 31, 1917, shows gross sales, less cost of manufacture and purchases and all expenses incident thereto, amounting to $3,140,560. Operating expenses, including salaries, commissions, engineering, selling and traveling expenses and rent of branch offices, were $919,947. Net earnings from sales were $2,220,613. Other income amounted to $257,269, making total net earnings of $2,477,882. There was reserved for 1917 federal taxes $450,000, leaving a balance for surplus account of $2,027,882. The balance of Dec. 31, 1916, amounted to $2,318,686. Dividends paid during 1917 aggregated $649,967, and "sundry adjustments of accounts and all items not incident to the current year" aggregated $102,009. The net surplus was $3,594,592.

School for Women Substation Operators.—Because of the existing and constantly increasing shortage of male labor due to war conditions, the generating department of the Edison Electric Illuminating Company of Boston has started a school for women substation operators. The school opened March 25 with fifteen members at the service buildings, and is being conducted by the laboratory, under the direction of P. J. Kent, system operator of the generating department. The school for women operators has been started as an experiment, to determine whether it is practicable, as a war measure, to substitute them for men in some substations. The women are receiving the same pay at this school that the men are receiving at the L Street school. Married men and men over the draft age will not be displaced by women, but only young single men of small experience.

Effect of Closing Window-Glass Factories.—With the first operating period allowed manufacturers of window glass by the United States Fuel Administration at an end, and the closing of approximately forty-five such plants, largely distributed through Pennsylvania, Ohio and West Virginia, a statement made public by John R. Johnston, secretary of the National Association of Window Glass Manufacturers, shows that the early closing order has resulted in a great saving of fuel, labor and freight capacity. The curtailment of output in the window-glass trade, according to the statement of Secretary Johnston, will save 450,000 tons of coal and 18,000 freight cars and release 5500 workmen for other labor. The direct loss to glass blowers, the statement says, will approximate $3,000,000, although this will be reduced by earnings in other industries. The resulting shortage in window glass is estimated at 5,500,000 boxes, or about half the yearly output of 11,000,000 boxes.

Opportunities in the Ordnance Department.—Two statistical engineers are needed by the Control Bureau, Ordnance Department, Washington. Each position calls for a man who is keen, an analyst, with vision, accomplished in the compilation of reports and statistics, and able to put himself in the reader's place. He should be a college or technical graduate and from thirty-five to fifty years of age. There is also an opportunity for two men along the same line but with less experience and younger. Four men are also wanted experienced in cost keeping and bookkeeping who have skill and initiative. They must be over the draft age. There is an opportunity here for men with and without college degrees. Women college graduates with mathematical ability and actual practical experience in such work as bookkeeping and statistics and able to make charts of various kinds are also desired. Address Chief of Personnel of Control Bureau, Chief of Ordnance Department, Washington, D. C.

Stevens Institute for Steam Engineering Training School.—The Navy Department, after consultation with President Humphreys, has designated the Stevens Institute of Technology, Hoboken, N. J., as the headquarters for the new United States Naval Steam Engineering School for the training of engineer officers for the United States Naval Auxiliary Reserve. This school is the only one devoted to training engineer officers for steam-engine service and is a branch of the large training school at Pelham Bay Park, New York. There is at Pelham, in addition to the school for general training of enlisted men, an officers' material school, Naval Auxiliary Reserve. Both the school at Pelham and the engineer officer school at Stevens are under the supervision of the supervisor of the Naval Auxiliary Reserve. The education of the engineer officers at Stevens is directed by Prof. F. L. Pryor of that college, who has been appointed by the Navy Department, with the approval of President Humphreys, civilian director.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Contracts in Illinois.—In an issue affecting the Normandie Hotel Company and the Commonwealth Edison Company, Chicago, the Illinois Public Utilities Commission says in part: "It appears that the consumer in signing a contract in August, 1916, signed it with a different name from that signed to the original contract. Knowledge that the café and hotel were operated under one management could only have been obtained through an inquiry into the business affairs of the consumer. Such an inquiry could hardly have been expected of the Commonwealth Edison Company and might have proved a source of embarrassment to the consumer. In case the company, acting in good faith, accepts a signature to an application for service, the commission believes that a practice requiring inquiry into the ownership of the business would result in imposing unwarranted expense upon the company and would further result in just complaint and criticism on the part of the consumer. The commission therefore finds that under conditions existing at the time of signing the contract, in August, 1916, the company was under no obligation to inquire into the ownership and management of these premises. A further question exists as to whether the company, after determining that an error has been made in signing the contract as hereinabove set forth, should be ordered to refund to the consumer the difference of bills which has resulted from this error. To impose this obligation upon the company would result in opening innumerable contentions for refunds, many of which might have a semblance of justice and many of which would be unjust, but all of which would involve an adjudication of issues which had arisen during times long since past. The adjudication of these issues, if conducted properly, would involve a large amount of investigation and expense. The liability of the company for the errors which it has committed, due to wrongful meter readings or discrepancies in billing, cannot be denied, but to extend this liability to cases which involve errors on the part of the consumer would offer problems of an entirely different character. Quite aside from any legal obligation and liability which the company may have in this or similar cases, and upon which the commission is not passing, to hold in this case that the reasonable practices of the utility warrant a refund of the overcharges would be in effect holding that the company is liable not only for its own errors but for the errors of its consumers. The commission believes that this would be unreasonable."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Charles H. Session has been appointed a member of the Kansas Public Utilities Commission.

R. T. Carruthers has been appointed district agent for the Southern California Edison Company in the Visalia district.

R. H. Ballard, second vice-president and assistant general manager of the Southern California Edison Company, in the rearrangement of titles becomes first vice-president.

Charles Strong has resigned as engineer for the Galva (Ill.) Electric Light Company to become connected with the Galesburg & Kewanee (Ill.) Electric Railway Company.

O. E. Hines, formerly new-business manager of the Washington (Ohio) Gas & Electric Company, will succeed C. B. Owens as manager of the Boonville (Mo.) Light, Heat & Power Company.

Harry Strapp, a load dispatcher for the Edison Electric Illuminating Company of Boston, Mass., has resigned to become superintendent of the Towns Electric Light Company, Harbor Grace, Newfoundland.

Jerome L. Cheney of Syracuse, N. Y., has been appointed a member of the Public Service Commission for the Second District of New York State, to fill the vacancy caused by the death of William Temple Emmet.

C. W. Beck, formerly superintendent of the Valparaiso (Ind.) Lighting Company, has been appointed manager of the Albion (Mich.) Lighting Company. Mr. Beck was graduated from the University of Nebraska in 1914.

Albert M. Grall, Webb City (Mo.) representative of the new-business department of the Empire District Electric Company, has been made new-business manager of the Ashland (Ohio) Gas & Electric Company.

George H. S. Mart, for the last seven years superintendent and commercial manager of the Knoxville (Tenn.) Railway & Light Company, has opened an office as a consulting and efficiency engineer in the Holston National Bank Building, Knoxville.

H. A. P. Langstaff, for the past two years associated with Willis L. Adams as electrical engineer, has resigned to become field electrical engineer for the J. G. White Engineering Corporation at Muscle Shoals, Ala., on the United States government nitrate plant No. 2.

Harry L. Thomson has been promoted from assistant superintendent of lighting of the Hartford (Conn.) Electric Company to superintendent of lighting, succeeding F. W. Prince. Mr. Thomson, who is a graduate of the Rensselaer Polytechnic Institute, has been connected with the Hartford company since 1910.

Arthur L. Mullergren, secretary-treasurer of the Benham Engineering Company, consulting engineers, Oklahoma City, Okla., has been commissioned a first lieutenant in the Quartermaster's Corps of the National Army and assigned for duty as officer in charge of light, power and ice, camp utilities division, Camp Funston, Kan.

J. R. Newell, formerly in charge of electrical construction, has been appointed superintendent of electrical operation for the British Columbia Electric Company, succeeding W. H. Fraser.

W. H. Fraser, superintendent of electrical operation for the British Columbia Company of Vancouver, B. C., has resigned that position to undertake similar work for the Mexican Light & Power Company at the city of Mexico.

Arthur Preger has been promoted by the Federal Light & Traction Company from the assistant treasurership of the Springfield (Mo.) Railway & Light Company and the Springfield Traction Company to be manager of the Albuquerque (N. M.) Electric Light & Power Company, succeeding W. P. Southard.

George Steinwedell, a former member of the new-business department of the Denver Gas & Electric Company, has been made manager of the Binghamton (N. Y.) Gas & Electric Company. On leaving Denver Mr. Steinwedell became advertising manager for the St. Paul Gas & Electric Company and then went East.

P. M. Downing, chief engineer of the electric department of the Pacific Gas & Electric Company, San Francisco, Cal., has been placed in charge of the combined operating plants of the Pacific Gas & Electric Company, Great Western Power Company and Sierra & San Francisco Power Company, which have pooled their activities as a means of aiding in the general conservation of fuel oil.

Prof. Philip B. Woodworth, dean of electrical engineering of Lewis Institute, Chicago, has entered the government service as a major in the aviation section of the Signal Corps. Professor Woodworth in 1910 became associated with the patent law firm of Rummler & Rummler, Chicago, where he gave his attention to applications for patents on electrical products and patent suits involving electrical points.

F. T. Morrissey, who has been associated with the Southern Illinois Light & Power Company and its subsidiary, the Saline Electric Company, for several years past as manager of its Duquoin (Ill.) properties and is at present district manager of its Eldorado group of properties, has resigned to become associated with the Indiana Railways & Light Company at Kokomo, Ind. Mr. Morrissey was previously connected with the Illinois Northern Utilities Company, the Kansas City Electric Light Company and the Eastern Michigan Edison Company.

C. B. Owens has resigned as manager of the Boonville (Mo.) Light, Heat & Power Company to enlist in the Thirty-seventh Engineers.

C. W. Squier has resigned as assistant electrical engineer of the Public Service Commission for the First District of New York to become a member of the editorial staff of the *Electric Railway Journal*.

Charles Philip Coleman has advanced in position from vice-president to president of the Worthington Pump & Machinery Corporation. Prior to becoming vice-president of the corporation, in May, 1916, he was receiver of the International Steam Pump Company, an associate company. Mr. Coleman, who is a graduate mechanical engineer of Lehigh University, has had considerable experience in industrial and railroad corporations. He joined the International Steam Pump Company in 1913 as vice-president, and upon the outbreak of the war in 1914 was made one of the co-receivers of the company, becoming sole receiver in 1915.

W. B. Voth has resigned as manager of the Ogdensburg (N. Y.) Street Railway, the Ogdensburg Power & Light Company and the Ogdensburg Gas Company to become manager of the properties at Eau Claire, Wis., operated by the Wisconsin-Minnesota Light & Power Company. Mr. Voth is a native of Milwaukee. He was graduated from the University of Wisconsin in 1897. After designing, constructing and operating several small hydroelectric plants in his native State, he was appointed resident engineer at Sheboygan in 1904 during the building of a steam station and the reconstruction of the local commercial and street-lighting system. After finishing the construction work, Mr. Voth remained to operate the plant as general superintendent. At the same time he acted as consulting engineer for the Greensboro (N. C.) company, controlled by the same interests. He resigned from these companies in 1914 to enter the service of the Empire United Railways.

C. R. Dooley, manager of the educational department of the Westinghouse Electric & Manufacturing Company, has been granted a leave of absence to enable him to accept an appointment by the government as director of the vocational educational project for army needs, now being developed by the War Department committee on educational and special training. He will be in the War Department at Washington. With the assembling of the first drafted men at Camp Sherman, Mr. Dooley was given the task of instituting and putting into operation a system of classification by which it is possible in a few minutes to select from the men in the cantonment the one best fitted for any particular class of service. The efficient manner in which this system was installed is largely responsible for Mr. Dooley's second call from the government. During Mr. Dooley's absence from the Westinghouse company his duties there will be assumed by C. S. Coler, who has been appointed acting manager of the educational department.

Louis H. Mather has been appointed superintendent of distribution for the gas and electrical department of the city of Norwich, Conn.

F. A. C. Tocque, formerly new-business manager of the Fort Smith (Ark.) Light & Traction Company, has passed the necessary examinations for entrance into the Canadian officers' training camp and will sail for England.

Fred M. Reast has resigned from the engineering inspection branch of the Western Electric Company to become a second lieutenant in the Quartermaster's Corps of the National Army and is now stationed at Camp Holabird, Baltimore, Md.

Ainslie A. Gray of the firm of Gray & Benjamin, advertising specialists, Chicago, has been commissioned major in the Ordnance Reserve Corps and will have charge of a new publicity bureau that will endeavor to co-ordinate the activities of the Ordnance Department and the industries through the medium of the technical and trade press. Formerly he was vice-president and general manager of the Electrical Review Publishing Company. He joined the staff of the *Electrical Review* in 1902, becoming managing editor in 1905. When the Electrical Review Publishing Company purchased the *Western Electrician* he became managing editor of the consolidated paper. In 1909 he also became general manager of the company and in 1914 was elected vice-president. He was made vice-president of the Chicago Trade Press Association in 1913 and the following year became its president. In 1915 he was elected president of the Federation of Trade Press Associations. In 1916 this body was reorganized as the Associated Business Papers, Inc., and Major Gray continued as its president until last year.

J. W. Welsh, electrical engineer and traffic agent of the Pittsburgh (Pa.) Railways, has been called to Washington, D. C., by A. Merritt Taylor, manager of passenger transportation of the Emergency Fleet Corporation of the United States Shipping Board. Mr. Welsh, who will serve on Mr. Taylor's staff, will assist in providing transportation facilities and remedying deficiencies, where such exist, in the shipyards on the Atlantic and Pacific coasts. Mr. Welsh became associated with the Pittsburgh Railways in 1906 as assistant electrician. In 1910 he was made electrical engineer and in 1913 took charge of the traffic department. Prior to this time he was employed as an electrical engineer by the National Tube Company, Wheeling, W. Va., and also by the Westinghouse Electric & Manufacturing Company at East Pittsburgh. He was graduated from Wittenberg College in 1900, Harvard University in 1901 and the Massachusetts Institute of Technology in 1903. He is a fellow in the American Institute of Electrical Engineers and several years ago erved as chairman of the Pittsburgh Section of this organization. Since 1914 he has been chairman of the power generation committee of the American Electric Railway Association.

J. S. Wharton, formerly manager of the Southern Gas & Improvement Company at Henderson, N. C., and having charge of the gas plants at Elizabetn City, N. C., and Rock Hill, S. C., has been appointed manager of the Helena (Ark.) Gas & Electric Company.

William H. Merrill, president of the Underwriters' Laboratories, Chicago, has been appointed section committee chairman of the newly organized fire prevention section of the War Industries Board of the Council of National Defense. Mr. Merrill is now in Washington to assume the duties of the new position for the period of the war. He brings to the fire prevention section experience in fire prevention engineering gained during a period of twenty-five years of active participation in nation-wide fire-prevention work. Four years after his graduation from the Massachusetts Institute of Technology, in 1889, he went to Chicago as electrician with the Chicago Underwriters' Association, and in the following year, upon association with the Western Insurance Union, organized the Underwriters' Bureau of Fire Protection Engineering. Mr. Merrill assisted in the organization of the electrical committee of the old Underwriters' National Electric Association, and participated in the conferences which resulted in the National Electrical Code. He was secretary-treasurer of the National Fire Protection Association and president two years, besides being for a long time a member of its executive committee and other important committees interested in the maintenance of electrical standards.

W. H. MERRILL

Obituary

James A. Scrymser, president of the Central and South American Cable Company and the Mexican Telegraph Company, died at his home in New York City on April 21, in his seventy-ninth year. Mr. Scrymser was a pioneer in the establishment of wire communication between the United States and Latin America, and in 1917 succeeded in establishing the first American-owned line direct between the United States and Brazil.

Charles H. Merritt, general manager of the Danbury (Conn.) & Bethel Gas & Electric Light Company, died April 3 in his seventy-fifth year. Mr. Merritt went to Danbury in 1868 and entered the shoe business, in which he continued until 1880, when he became interested in the hat trade, in which he remained until his retirement in 1907. Before 1880, however, Mr. Merritt had become a public utility figure in Danbury, he having been connected with the old gas company and later with the electric company, becoming president and general manager while still in the hat business. When the Doherty interests took over the Danbury company in 1912 Mr. Merritt headed it, and he has remained in that position ever since. Mr. Merritt's local activities extended far beyond business, however, and he was very active in charitable and social work.

Dr. Ferdinand Braun, who in 1910 shared with William Marconi the Nobel prize for physics awarded for services to humanity through the invention of improved methods in wireless telegraphy, died in New York City on April 20 in his sixty-ninth year. Dr. Braun was born at Fulda on June 6, 1850, and received his education at the universities of Marburg and Berlin, graduating from the latter in 1872. In 1895 he was appointed director of physics at the University of Strassburg. He came to this country in 1915 as a witness in the litigation between the Marconi company and the German company which operated the wireless plant at Sayville, Long Island, and Tuckerton, N. J. His early studies were devoted largely to mechanical oscillations, but later he devoted his attention chiefly to research on electrical problems, and more particularly to radiotelegraphy.

James P. Merrihew, one of the oldest of the telegraph and telephone engineers, has recently died at the age of eighty. He started his career as a messenger boy with the Western Union and at the age of sixteen was manager of a telegraph office in a small New Jersey town. About 1877 Mr. Merrihew and the late W. T. Westbrook, Sr., secured a license from the American Speaking Telephone Company and established exchanges at Wilmington, Chester and Trenton, under the firm name of J. P. Merrihew & Company. On July 18, 1882, the Delaware & Atlantic Telephone & Telegraph Company was organized by Mr. Merrihew at New York, and a few months later a similarly named company was incorporated under the laws of the State of Pennsylvania. He was the first president and also a member of the board of directors and remained at the head of these conferences until July, 1897. For a number of years he was president of the Bell Telephone Company of Philadelphia. In the early seventies he was manager of the Western Union force in Philadelphia and later became superintendent of the sixth district. About the year 1880 he became the general superintendent of the Western Union company.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

DEMAND FOR TRANSFORMERS HAS DROPPED CONSIDERABLY

Shipments Can Now Be Made Under Six Months on All Sizes and Types—Stock on Smaller Sizes Is Being Accumulated

Since early last fall transformer business has dropped from the high level occasioned by the entry of the United States into the war. Present-day demand is probably in the neighborhood of 70 per cent of what it was ten months to a year ago. During the past few weeks the demand has been noticed to rise somewhat, and indications are for a continuance of the present volume of business.

While it is true that the manufacturers have by no means entirely caught up with old business, deliveries are now much closer to normal. In some sizes and types stocks are beginning to accumulate. Present manufacturing capacity is now in excess of current demand.

Shipments on all sizes, even for special construction, are now being made well under six months. Under 50 kva. shipment in four weeks is being promised, and in many cases orders are being filled from stock. Longer time is required for larger sizes, but only recently some very large transformers were ready for shipment in four months.

There does not seem to be any tendency toward lower prices, while there is some talk by manufacturers of higher prices if raw materials continue to advance. Present contracts, of course, will not be affected, but new contracts may be made on a different schedule or price basis. Boiler plate and cotton thread are at present the most alarming of the raw materials. Transformer oil deliveries are now in better condition, and the supply of oil drums is freer.

Obey That Impulse—Buy a Bond

RETURN-GOODS NUISANCE SUPPRESSED BY JOBBERS

Dealers or Contractors Must Obtain Permission Before Credit Is Allowed—Rigorous Rule to Bring This About Is Applied

Returning merchandise to the jobber, distributer or manufacturer by the dealer or contractor, at their own discretion, and demanding credit allowance in addition, without first obtaining permission, has been greatly abused. In fact, to accept the statement of a number of jobbing houses, the practice had actually become a menace, so widely was the custom followed. Other lines of business have been victimized in the same way by unscrupulous buyers, so much so that organized efforts to lessen the evil, if not wholly suppress it, have received special attention at the hands of trade associations. It is generally admitted, however, that keen competition for orders is alone responsible for these and similar loose business methods. Conditions since the advent of the war have changed radically.

Jobbers may differ in their ways of handling the return-goods problem, but after inquiry it is ascertained that concerns of standing have a rule in connection therewith which they enforce. The following, appearing in a recent price list of a prominent jobber, is a fair sample of them all:

"No goods can be returned for credit without our permission, first obtaining our return-goods tag, to be attached to goods returned. All goods returned for credit must be in salable condition, and all charges must be prepaid. A minimum service charge of 20 per cent will be made on all standard apparatus returned for credit. No permission will be given to return apparatus of any special finish, design or capacity. No permission will be given to return apparatus that has been shipped over sixty days."

Every Bond Brings Victory Nearer

TEMPERAMENTAL WORKMEN AT WIRE PLANTS TROUBLESOME

Skilled Operatives Have Peculiarities as Specialists and Have a Tendency to Be Shifting All the Time

Besides the difficulty of obtaining early or prompt delivery of copper to the wire drawers and manufacturers, labor at these plants is not only short but at times creates embarrassing conditions. One large wire producer said the major part of the labor force were foreigners—Poles in many instances. They are skilled men, excellent artisans, but inclined to be "temperamental." The practice at this and other plants is to use the working operatives to the best advantage.

Occasionally the supply of bare copper wire runs low, and replenishment cannot always be accomplished now readily and promptly. At such periods the management shifts these men to other departments and on different tasks. This is resented. The workers prefer to follow one particular line in which they are proficient and skilled. Consequently when a shift is made to conserve time and material these workmen not infrequently "throw up" their jobs and leave for other wire plants where perhaps their specialty may be followed. The absence is usually brief, for the same procedure brings the easily ruffled workman back to his original place of employment and temporary contentment. It is said that there is continually a round of changes on this account. While this break in the plant's working personnel is a source of annoyance, the frequent holidays—mostly of a religious character—also upset the smooth running of the factory and cut down the output. One day is not sufficient to attend to these duties, but two are usually the rule and not the exception.

Let Your Gold Eagles Rout the Hun

FAN PRODUCTION MAY FALL SHORT OF REQUIREMENTS

Government Needs, Running Into Great Quantities, Largely Overlooked—Difficulty Met in Obtaining Transportation

An investigation seems to prove conclusively that electric fans will be in none too plentiful supply by the time the retail selling season arrives. Several manufacturers admit the possibility of a shortage at the present time. Inquiries for additional stocks are already coming in. No one, it is averred, foresaw the enormous governmental requirements for military and naval needs at the camps, aboard ships, at hospital bases, and for various other purposes. The departments in Washington are also reported to be short of an adequate supply, so much so that with the arrival of the recent warm spell the local trade at the capital had its entire stocks absorbed.

One jobber from there came to New York and placed an order for 1500 fans with a leading manufacturer for early if not immediate shipment. This could not be complied with, but an effort was made to obtain as many as possible from the company's distributers, the remainder of the specifications to be made up and delivery promised in six week to two months.

In accordance with the statement of a leading manufacturer, whose output is an important factor, it will be impossible to get the material to keep the production of fans up to the demands of a normal season. It was made clear that last year, which recorded an unprecedented sale, every nook and corner of factories, warehouses, stores and even cellars was ransacked for fans in any condition that could be made salable. The result is that the market is bare. With this knowledge before them, distributers, territorial agents and jobbers in many instances doubled their orders for 1918.

Where a good stock of raw material is assured, more or less difficulty is being encountered in the retention of skilled workmen. Prices are now quoted f. o. b. local stocks or factory, and a change in price on new business may come along without previous notice. One manufacturer is known to have stocks exceeding last year's supply by 100 per cent in Eastern warehouses. Trouble is being found in obtaining priority shipping orders. A Philadelphia distributer requested an order for sixteen cars from a Middle West factory and was "turned down." A requisition for two cars by a New York house resulted in having an order for one granted and subsequently an order for the other. One manufacturer of prominence is not accepting any more business.

A Father's Mite—A Bond

METAL MARKET SITUATION

Supply of Copper Liberal—Wire Base Price Nominal —Tin Reaching High Figures

No uneasiness is expressed regarding the quantity of copper accessible and available for all purposes. So much is this the case that the arguments for a higher government price than 23.50 cents fell flat. One large producer in a report to his company last week said that the cost of mining and refining was 11 cents a pound. Wire base is quoted at 27 cents to 30 cents, which is nominal, actual sales for wire products being a case of negotiation. An authority states that "bare copper wire for electrical purposes, carloads and mill shipments, is quoted at 26 cents per pound base."

Tin, as far as spot may be quoted, is now over 90 cents per pound. A few lots of Chinese tin were sold last week at 91 cents, with 84 cents for April shipment. The market is unstable. Commandeering of all platinum by the government for the manufacture of electrical instruments and other war purposes is threatened. The War Industries Board has warned holders of the metal that not more than $100 an ounce will be paid for commandeered platinum.

NEW YORK METAL MARKET PRICES

	April 15	April 22
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25 to 26.75
Lead, trust price	7.00	7.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	6.92½ to 7.02½	6.83 to 6.87
Tin, Straits	85.00	92.00
Aluminum, 98 to 99 per cent.	Govt. price 32.10	Govt. price 32.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 14.00	13.50 to 13.75
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	5.75 to 6.00	5.75 to 6.00
Zinc, old scrap	5.50 to 5.62½	5.50 to 5.62½

THE WEEK
IN TRADE

WITH a very fair volume of commercial business recorded in all parts of the country, government orders continue to dominate all lines in the electrical field. Deliveries have slightly improved, but the ever-present embargoes interfere greatly with the calculations of jobbers and dealers in keeping their stocks of staples and leading specialties in a normal condition. Delays in transportation are particularly acute in the Far West. Building operations are confined to necessities and those localities where war industries require unusual housing accommodations.

Sales are strong, in many instances heavy, on armored cable, conduit and large-size lamps, with enlarged transactions in renewable fuses, rubber-covered wire, sewing and washing machines. The fan situation is attracting attention, and a shortage is freely and frankly discussed as a possibility. A scarcity in certain staples is also evident. The curtailment of labor is causing concern, jobbers and dealers on the Pacific Coast stating that it is impossible to obtain and hold competent assistance.

Collections are encouraging, and credits are being limited and shortened to keep business in a liquid condition.

NEW YORK

In a general way business in the sale and distribution of electrical goods is very satisfactory. Manufacturing plants are running to capacity, some of them reducing accumulated contracts as the progressive transportation improvement, in the aggregate, makes freer deliveries of raw material and products possible. However, there is yet an inadequate supply of cars for both inbound and outbound tonnage. The factories, with scarcely a single exception, remain handicapped by the scarcity of experienced workmen, and the steadily increasing costs of production, through rising wages and other causes, apparently render further upward price revisions in some lines inevitable. Within the last month prices have been remarkably even.

Reports that the financing of the third Liberty loan was interfering with collections seem to be without substantial foundation. Credits, nevertheless, are firmly held up to the line of safety.

PORTABLE LAMPS.—Floor and table lamps are mentioned as fast sellers. Fine finishes and beauty of design prove attractive to jobber, dealer and ultimate consumer. Prices vary in accordance with these features,

COLLECTIONS AND CREDITS.—If collections have fallen off on account of investments in the drive to make the third Liberty loan an overwhelming success, it is not conceded in the electrical field.

HOUSEHOLD SPECIALTIES.—Warm weather lines are moving rapidly. A special effort on electrically equipped ironers and scrubbers of an improved type is bringing in satisfactory returns. The sale on toasters, grills, flatirons, sewing and washing machines and vacuum cleaners is far ahead of last year's record. Stocks are strong notwithstanding transportation difficulties.

FANS.—With the advent of a few warm days and others to follow in due course, the retail fan season has opened up with an unexpected showing of strength. Some manufacturers state that jobbers and dealers who have not "signed up" may be treated to a surprise in a raise of prices, as a shortage is generally conceded to be in sight.

LAMPS.—Supplies in all sizes are not so good as they should be, to repeat the statement of the largest jobbers. A shortage is still reported.

CONDUIT.—The larger sizes are particularly scarce. The smaller are in better supply, but not a great deal better.

DRY BATTERIES.—Stocks are reported to be in excellent shape. Deliveries are being made from factories in about ten days..

SMALL MOTORS.—Government demands for small direct-current motors, for use in the trenches abroad in connection with signaling devices, have nearly cleaned up the market, to quote one of the largest manufacturers. It is not easy, therefore, to deliver motors of 10 hp. under 60 to 120 days, which also applies to those of 2 hp. and below. On larger sizes of motors, from 25 hp. to 50 hp., where the frames are coming through or in stock, deliveries are better.

GLASS INSULATORS.—On April 1 glass insulators were advanced 10 per cent. The market is close and deliveries out of stock, but not guaranteed.

LOCUST PINS.—Conditions are very unsettled, changes in price occurring frequently owing to specifications for definite delivery dates. Quotations are $2 to $3 per 1000 higher, f.o.b. mill, with indications of a still further increase.

CHICAGO

Government business is coming to Chicago in larger volume. Apparently this is due to two things—first, the decentralized control of purchasing for the Ordnance Department; second, the lack of power facilities among the central stations in the East. An army officer at one of the ordnance depots in Chicago is responsible for the statement that the department here is doing a business of $1,000,000 a day now, whereas only a little more than a year ago that business was about $1,000,000 a year. Practically all of the officers in the Ordnance Department seem to recognize that the shortage of power exists in the East and that more business must be pushed into the Middle West. Vast quantities of warehouse space have recently been secured in Chicago through the aid of the Chamber of Commerce. It is expected that more will be needed, as the plan apparently is to continue production at top speed regardless of shipping, so that when the ships are available there will be no delay in sending the materials abroad. Even organized labor in Chicago seems to have awakened to the situation, as all of the building trade unions, including the electrical workers, have now signed a no-strike agreement for the duration of the war. Payments on government contracts are being speeded up, and this, it is expected, will have a good effect on the general collection situation. Jobbing business remains about the same, a spotty condition prevailing.

PINS AND BRACKETS.—Locust pins and brackets have taken another increase in price, amounting to from 10 to 20 per cent. Locust is very difficult to get, large quantities of it going into the war activities. Jobbers are being asked to push rock-elm pins and brackets.

CONDUIT.—Jobbers' stocks of conduit are still low. It is possible, however, to get good deliveries in some instances by carefully searching through the trade.

PORCELAIN.—Jobbers report that it is necessary to order about six months in advance and that manufacturers are not taking orders at stipulated prices, but are quoting only "price as of date of shipment."

SECOND-HAND MACHINERY.—Business for the last week has been rather slack, but indications are that it will take a sharp upturn, as inquiries during the latter part of this week have been very many. The repair shops of second-hand machinery places are exceptionally busy. It is predicted with considerable confidence that higher rates for repair of electrical machinery will shortly go into effect.

SMALL MOTORS.—Single phase, three-phase and direct-current motors of small sizes are moving in good volume. This includes motors up to 5 hp.

LIGHTING FIXTURES.—Business in lighting fixtures is decidedly off in volume. Some of the Chicago factories are bidding on such government business as trench mirrors and other small metal articles in order to occupy their factories.

BOSTON

The electrical trade is getting more and more "into phase" with the "win the war" movement each week. Although jobbers report a moderate recession in the volume of business, underlying conditions are held to be sound. Fairly good collections indicate this. Credits are closely watched, but a large amount of money is in circulation and a goodly share is flowing into the coffers of the electrical industry. Jobbers are getting ready to handle the immense amount of detail orders which will be required by the quartermaster's terminal now under construction at Boston. Preliminary wiring of field structures has begun and the rush of orders will soon be on. The shipyards are buying substantially, motors and wiring supplies being in great demand.

Stocks are generally in good shape and deliveries are improving, with the marked exceptions of conduit and porcelain.

FIXTURES.—Inquiries from summer home owners are coming in faster than was anticipated considering the quiet state of trade heretofore. A drive is also under way to capture the business of the summer hotel in connection with remodeling of old establishments. Prices show little change beyond an occasional shading to stimulate buying in the off-season period. Stocks are large and well adapted to varied requirements.

STORAGE BATTERIES.—A heavy demand for batteries is now being maintained by the automobile trade. The accumulation of stocks is very difficult as to local agencies. In some quarters an advance in the price of lead batteries would not be a surprise, in view of the increased prices lately put into effect by competing makes, but nothing definite is as yet given out on this. Government business holds up well.

MOTORS.—Deliveries are improving, one dealer stating that in a general way quotations have been reduced from a matter of months to a matter of weeks on shipments. Up to 50 hp. deliveries of from four to six weeks are not uncommon. Now and then motors slip into factory stock, but their tenure of residence is apt to be short. Unless advances in steel and copper occur before July well-informed opinion holds that motor prices will hold firm for the present. Shipyards are buying motors for both steel and woodworking tool service, air compressors, etc.

CONDUIT.—The situation continues discouraging. A recent inquiry for ⅜-in. pipe brought out the fact that the mill in question cannot start rolling this size until the last of May, making a three months' gap in this output from shipment to rolling. Long delays are prevalent in delivery of orders placed some time ago.

FANS.—Fans are going out to the retailer now in good volume. The jobbers continue to report receipts from the factories in carload lots.

POLE-LINE MATERIAL.—Very little buying is noted by central stations in comparison with peace times. Some orders are being handled in connection with energy supply to war service plants. Municipal purchases for fire-alarm work, etc., hold up well, but are, of course, small in volume compared with the normal absorption of the central stations.

ATLANTA

The large expenditures along governmental lines in the South during 1918 will create a greater market for electrical goods of all descriptions. That this condition will exist is borne out by the fact that somewhere in the neighborhood of $275,000,000 has been appropriated for nitrate plants, shipbuilding yards and enlargements to military establishments, together with the development of those minerals which are vital to the winning of the war. Kingsport, Tenn., is proving to be a big center of activity in the munitions line, and a nitrate plant, with an accompanying industrial city, costing $10,000,000, is now contemplated for this point, in addition to the manufacture of acetone and other by-products now under way. The War Department has also decided upon an outlay of $20,000,000 for building piers and warehouses at Charleston, S. C. As the war has

greatly stimulated the demand for denatured alcohol from sawmill waste, a number of these plants in the lumber belt are being equipped.

The Lamb-Fish Lumber Company, Charleston, Miss., has let contracts for construction this week. Wilmington, N. C., has secured a million-dollar plant for concrete ship construction. Reports received from Washington indicate that it has been definitely decided to enlarge Camp Gordon to take care of 60,000 men, which will entail an expenditure of $4,000,000. Other construction contemplated for Atlanta includes $1,500,000 for additional hospital buildings at Fort McPherson and a reclamation plant employing 2500 men. Details for this plant are not available at this time.

ARMORED CABLE.—A big business has been recorded this week, and a number of the well-distributed stocks of the past few weeks have almost been cleaned out. Large quantities of this material have been shipped to Columbia, S. C., Jacksonville, Fla., and other cantonment centers. Inquiries reveal the fact, however, that the demand is from commercial sources, and there is no indication that any is being purchased for government account. Manufacturers report a scarcity of raw materials, at least temporarily, with an advance of 5 per cent in price. Two-wire, No. 14, is very scarce.

INCLOSED SAFETY SWITCHES.—Jobbers' representatives state that business in these shows a strong tendency. The demand has been accelerated by the activity of the inspection departments of a number of Southeastern cities, which have passed ordinances of a nature that facilitates sales. Shipments are reported as being very good.

RENEWABLE FUSES.—All the dealers and jobbers are securing some good orders and business seems to be increasing daily. Deliveries are excellent.

SEWING-MACHINE MOTORS.—Every one dealing in this appliance appears to be doing a very substantial business. The volume of sales is well ahead of the same period last year. One large jobber reports large sales on the complete outfits, which include sewing machine and motor. Deliveries are fair.

VACUUM CLEANERS.—The industry has experienced a larger trade in cleaners this spring than ever in the past.

SEATTLE

Prosperous activity is general among retail trade, with a gratifying reflex upon wholesalers. Specifically, in the past week the volume of sales was as satisfactory as during several weeks past. Sales to shipyards, as in the past, constituted the bulk of business transacted, although allied industrial plants did considerable buying. Orders for lumber mills show a slight increase. Government buying shows a decrease over last month.

Portland territory during the past week reports a large order for a complete electrical equipment for grain elevators, also the receipt of numerous inquiries for other elevators in contemplation in the Spokane territory. It also reports sales of electrical equipment complete for elevators in the Inland Empire. Portland jobbers report heavy sales of electrical machinery equipment and supplies to shipyards in Portland, Vancouver, Wash., and Astoria. Yards in Vancouver especially have been buying heavily lately.

The largest jobbing houses in the Northwest agree that the labor situation has never been equaled. The shortage of men, particularly of the draft age, is almost unbelievable. Jobbers report that warehousemen and clerks are impossible to obtain and hold. Retailers in many cases are resorting to female help. The electrical industry in all its various branches is seriously threatened. In Seattle particularly the shortage is most acute. The local traction company cannot secure men to operate the street cars and service is disorganized. The telephone company is hampered by a scarcity of outside men as well as of clerical force.

Difficulty in securing shipments of badly needed materials is causing anxiety. In several cases shipments have been en route for two months. L. C. L. shipments are particularly affected. Extreme shortages exist in rubber-covered wire, conduit and larger-sized lamps, and present indications are far from promising. The Seattle territory especially reports continued heavy sales of sewing machines and washing machines. Other domestic appliances are moving satisfactorily. Retailers report an increasing volume in the sale of house-wiring materials and fixtures, including chandeliers and shades. Electrical novelties are moving well. A slight increase in weatherproof wire is noted, the first increase mentioned for the past month.

The Northwest lumbermen feel that the curtailment of the government's wooden shipbuilding activities, tentatively announced recently, will not affect the fir lumber industry of the Northwest adversely.

SAN FRANCISCO

Business is very good and factory deliveries are better, save on conduit. A fair has been held at Davis, where farm plants and 32-volt appliances were featured. It was well attended and is expected to accomplish educational work. We are now in the year's first hot spell, which, coming as it does after a late rainfall, will hasten needed crops.

CONDUIT.—Conduit sales are slightly less than those of last year, but this is due to the difficulty of deliveries and the fact that many dealers were given an opportunity to stock on the old price basis. This is especially true of at least one of the largest shipbuilding plants, whose past purchases will carry it well on into 1918.

RUBBER-COVERED WIRE.—Jobbers report increased sales of rubber-covered wire, in some cases as high as 25 per cent over last year's showing.

FANS.—Dealers are found to be very cautious in estimating their requirements for the 1918 season, complaining in general that they carried over unusually large surpluses from last year's stock and do not anticipate a normal demand this year; but those whose position enables them to survey the entire field are positive that this will be a good fan year, principally because of the widely scattered industrial plants (especially canneries in the central valleys) that have been hastily constructed with practically no provisions for ventilation.

INSULATING MATERIAL.—The United States government is requiring plenty of fiber, and the shortage of large motors, which makes much rewinding imperative, causes it to requisition much cotton tape and insulating compound. Deliveries are now very good, even of cotton tape, which has been practically an unknown quantity for months past. The market on silk tape is upset, owing to unexpected survivals of stock purchased at former prices, which were very small in proportion to those now effective.

HEATING DEVICES.—Present demands are rather poor and surplus stocks are on hand. Flatirons are selling at a little less than the normal rate, but devices such as toasters and percolators are barely moving. It is evident that more intensive effort must be made before the real buying public is reached. One of the best selling heating devices is the heating pad, on account of a considerable amount of prevalent sickness. The unusually warm and dry winter spoiled the radiator season.

WASHING MACHINES.—The demand for washing machines is better than ever and is to be further stimulated by billboard displays. Prices have just advanced so that washers for the average household now list at $115 in place of $105, and washers for small families have jumped from $80 to $90 each. In spite of this fact the demand is good.

DRY BATTERIES.—Dry-battery sales are running about 20 per cent above those of last year, owing to the increasing number of electric trucks, long haul requirements, and, of course, the ever-increasing number of automobiles in service. The United States government, for instance, hauls a large portion of its requirements by its own fleet of motor trucks from San Francisco.

FLASHLAMPS.—Flashlamp sales are excellent. Deliveries are very good on account of the Pacific Coast factories for the manufacture of renewals. The presence of thousands of soldiers, many of whom have been generously remembered by gifts of flashlamps, augments the steady battery demand.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to $61.00
Coil to 1000 ft	10% to 57.25
	No. 12 Solid
Less than coil	List to $71.00
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List to $104.00
Coil to 1000 ft	$97.75 to 10%
	No. 12 Solid
Less than coil	List to $135
Coil to 1000 ft	10% to $126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std pkg	10% to $24.00
1/5 to std. pkg	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	20% to List
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3275-.3295
Barrel lots	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	Net to $75.00	—15% to $69.75
⅜-in. d. stp.	+10% to 75.00	List to 72.00
½-in. s. stp.	List to 100.00	—15% to 93.00
½-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75
⅜-in. double strip	78.25-78.75	71.25-71.75
½-in. single strip	100.00	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$25.00-$55.00	$20.50-$24.45	$20.00-$21.50
¼-in.—		
$28.00-$60.00	$22.50-$27.00	$22.00-$23.50

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$36.00-$55.00	$25.00	$22.50
¼-in.—		
$40.00-$60.00	$27.00	$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12%	7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	5.3% to 8.9%	8.3% to 11.9%
2500-5000 lb.	7.3% to 10.9%	10.3% to 13.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	20% to 30%
1/5 to std. pkg.	38% to 40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00
1/5 to std. pkg.	4.50

Standard packages, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard packages, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00 to $34.90
Coil to 1000 ft.	26.20 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, AX, 1½ 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N. C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to $11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets.	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to $23.00
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to 25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100 amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	10% to 11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt. D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List 40%	Net to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$4.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0.41¼-$0.44¼
No. 18, full spools	0.36¼- 0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11..	$15.00-$18.00	$12.50-$13.00	$9.85-$11.50
12..	23-25- 25.40	21.30- 21.80	15.95- 19.35
10..	32.40- 35.20	29.70- 30.20	22.10- 27.00
8..	45.70- 49.15	41.90- 42.10	30.85- 38.00
6..	72.40- 77.85	66.35- 66.75	48.95- 60.30

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14..	$18.00	$13.00	$11.50
12..	25.33-$26.28	22.02-$25.33	18.35-$20.93
10..	30.49- 36.54	27.94- 31.26	22.86- 29.23
8..	42.54- 51.57	38.99- 44.13	31.90- 41.36
6..	66.46- 88.38	56.15- 75.61	50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25 ....
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.42 to $40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

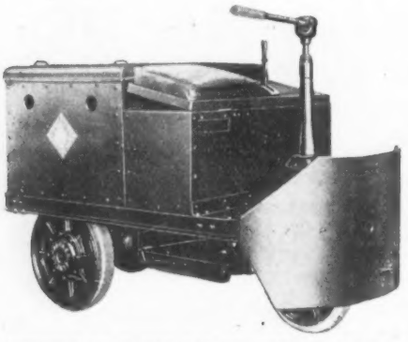
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Coal Conveyor That Requires Only One Man to Operate

A mechanical conveyor that will load and unload auto-trucks and wagons very quickly is being manufactured by John F. Godfrey of Elkhart, Ind. A single-rope overhead cable is employed to support the bucket. The conveyor can be operated by one man, who loads the bucket directly from the truck, hoists it to another truck or to the storage pile. The conveyor bucket runs along the cable until it reaches a movable trip and there empties its load upon the pile. It is claimed that in a hundred feet of cable length 1000 tons of coal can be stored by this device.

Medium-Service Electric Truck

A three-wheel tractor designed for service of a character between that accomplished by the carrier truck and the heavy-duty tractor is being manufactured by the Elwood-Parker Electric Company of Cleveland, Ohio. The most distinctive feature of this tractor is the single front wheel, which is steered by a hand-wheel or hinged lever on the body of the tractor. When the wheel steer is used the control lever is placed on the left of the column, but when the lever steer is installed the control lever is provided at the side of the operator's seat as shown in the accompanying illustration. The tractor cannot be started from the floor because the seat operates a circuit breaker which closes when the operator's weight presses on the seat. The battery is



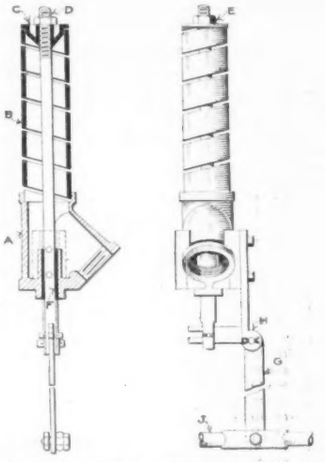
OUTSIDE TURNING RADIUS LESS THAN THE LENGTH OF THE TRACTOR

arranged so that the weight is over the drivers.

Solid wheels as well as solid rubber tires are provided, and the tractor has a normal drawbar pull of 300 lb. (136 kg.) and maximum pull of 850 lb. (385 kg.) The speed at no load is 625 ft. (190 m.) per minute. Its length is 70 in. (178 cm.) and its width 41 in. (104 cm.). The outside turning radius is less than the length of the tractor.

Adjustable Spray-Head for Cooling Tanks

A spray-head equipped with convenient adjusting gear that can be actuated from the shore is being manufactured by the Yarnall-Waring Company, Chestnut Hill, Philadelphia. Referring to the diagram produced herewith, *A* indicates the cast-iron body of the device to which a 3.25-in. (8.2-cm.) bronze tube, *B*, is secured. A helical opening of coarse pitch is cut in the tube through which the sprayed water leaves the nozzle at



SPRAY-HEAD WITH ADJUSTABLE WATER APERTURE

an angle of 60 deg. to the axis of the tube. By moving the bar *J* to the left the cap *C* is pressed against the helically slotted tube, thus reducing the slot opening through which the water issues.

The manufacturer claims that the maximum cooling effect is obtained under all conditions of temperature and humidity, that the minimum loss of water by driftage due to wind results, and that a high efficiency is obtained at fractional loads by the use of this spray-head.

14,000-Kva. Single-Phase Transformer

The accompanying illustration shows the framework and bracing arrangement of a large single-phase transformer recently manufactured by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The transformer is rated at 14,000 kva., 60 cycles and 150,000 volts. The transformer, which is of the shell type, has

LARGE SINGLE-PHASE TRANSFORMER DESIGNED FOR 150,000-VOLT SERVICE

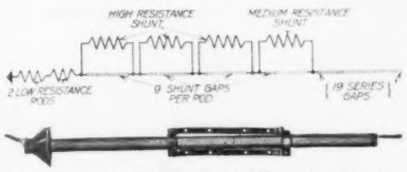
a 25 per cent overload rating, which gives a maximum rating of practically 17,500 kva. The top and bottom ends of the coil are held against distortion by two heavy steel plates reinforced by four lengths of angle iron riveted to them. These angle-iron plates are held together by four heavy tie-rods. The transformer tanks are made of heavy boiler plate, all seams being oxy-acetylene-welded. The tank is supported by a structural-steel base equipped with wheels. The high-tension terminals are of the condenser type protected by means of a number of porcelain rain shields to adapt them to outdoor service. The transformer is 23 ft. 6 in. (7.2 m.) over all in height, and weighs, complete with oil and fittings, about 110,000 lb. (49,895 kg.).

Sensitive Lightning Arrester for Pole Transformers

A multi-gap shunt-resistance lightning arrester in which the gaps shunt the resistance has been developed by the General Electric Company, Schenectady, N. Y. The arrester is of the compression-chamber type and is adapted for the protection of distribution transformers. By mounting the combination of gaps and shunt-resistance rods in porcelain tubes a high degree of sensitiveness to lightning disturbances is obtained. It is claimed that the arrester will discharge with small increases in potential, will divert lightning disturbances having a wide range of frequency and will quickly cut off

the dynamic power supply after the transient disturbance has passed. It also prevents grounds and "shorts" on the transformer.

Numerous paths are offered for the discharge of lightning through the arrester by the four units of shunting resistance used. As the resistance rod shunted across the series gaps is grounded through the other resistances, the initial discharge is minimized. The path which the discharge travels after passing through the series

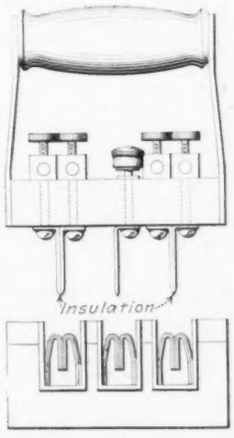


"RESISTANCE MULTI-GAP" LIGHTNING ARRESTER

gaps depends on the frequency and power back of the discharge. Very high frequency will cause a discharge straight across all the gaps, whereas discharges of lower frequency will take place through one of the shunt paths. The generator current which tends to follow the lightning discharge will be diverted through the resistance rods and thereby limited to a value that can be readily extinguished by the gaps.

Testing Blocks That Assure Accurate Results

A terminal block for use in testing electrical machinery which, it is claimed, will assure accurate results has been developed by the Metropolitan Engineering Company, 35 Vestry Street, New York City. The device consists of phosphor-bronze clips mounted on a porcelain block in such a manner that opposite sides of the clips are connected



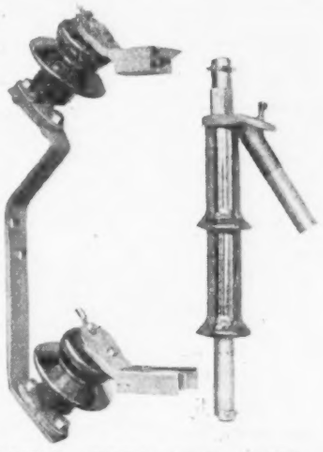
BLOCK PERMITS CONNECTION OF METERS WITHOUT INTERRUPTING SERVICE

to the corresponding incoming and outgoing circuits. The outline diagram presented herewith shows the portion of the testing block which is permanently installed in the circuit, and above it the portable portion to which the testing meters are connected.

The current-tapping blades on the portable portion consist of phosphor-bronze strips separated by a thin layer of micarta insulation. The meters are connected across the bronze strips so that when the blades are inserted in the clips on the testing block the meters are connected in series with the circuit. The middle terminal of the three-phase portable block shown is a potential tap and also consists of a strip of bronze. By using this block for testing the necessity of making temporary connections with wire jumpers is avoided. fire hazard is reduced, and the necessity of stopping a machine to insert meters is eliminated.

Outdoor Fuse and Disconnecting Switch

A combined fuse and disconnecting switch for use with transformers where no primary switches are used is being manufactured by the General Electric Company, Schenectady, N. Y. The fuse is suitable for interrupting the exciting current of transformer banks rated at



EXPLOSION WHEN FUSE BLOWS AND EXTINGUISHES ARC

not more than 300 kva. To open the circuit the holder is lifted completely out of the contacts by the fuse hook handled from the ground. The upper end of the fuse holder can be hung from the cap which partly surrounds the lower contact clips when the switch is open. To close the circuit the upper contact of the holder is inserted in the upper clips first and the lower contact is then pressed into the lower clips by the hook.

The fuse holder has petticoats spaced so as to provide ample creepage surface. The brass contact parts at the ends of the fuse holder engage with the stationary contacts on the supporting insulators when the holder is in normal operating or closed position.

The contacts are protected against the effects of ice, sleet and snow by the hood attached to the top of each supporting insulator and by the relative position of the parts. The fuse element passes through the center of a fiber tube within the porcelain fuse holder and is attached to the upper closed end of the fuse holder by means of an adjustable clamp and to the lower open end by a circular ring. When the ring is tightened it holds the fuse firmly in place and prevents it from shearing off when the element blows. The expansion of the gases formed, occurring after the fuse has ruptured, effectively expels the arc through the open end of the holder in a downward direction, thereby opening the circuit. New fuses may be readily inserted.

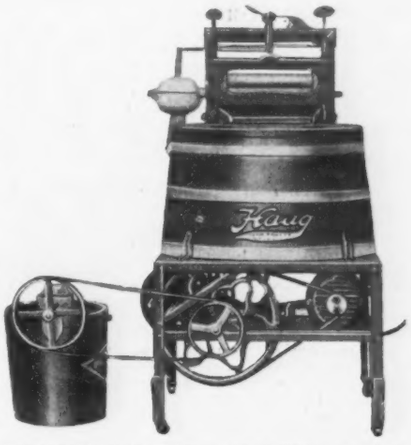
The device is listed as the type TD-127 and is made in single-pole units for vertical mounting on flat surfaces. It can be obtained for use on 15,000, 22,000, 35,000 and 45,000-volt circuits with a maximum current rating of 50 amp. No special arrangements are needed for mounting. The supporting bracket is bolted to the cross-arm of the supporting structure.

Lightning Protector for Substation Telephone Circuits

A self-cleaning saw-tooth lightning arrester is being manufactured by the Reliable Electric Company, 411 South Sangamon Street, Chicago. The protectors, which have been approved by the National Board of Fire Underwriters, consist of copper blocks entirely inclosed by covers that surround the fuses as well as the rest of the lightning arrester. The fuse cases are made of tubular fiber, tubular magnesia, tubular wood, flat wood, folded mica or folded fiber. They can be easily rewired.

Motor-Driven Washing Machine

A motor-driven washing machine which is equipped with an extra pulley that can be used to drive water pumps, turn ice-cream freezers and other small



WASHING MACHINE HAS EXTRA PULLEY FOR DRIVING OTHER MACHINERY

machinery has been brought out by the Haag Brothers Company of Peoria, Ill. The washing machine, known as the "Nuway," is of the dolly type and is equipped with a varnished wood tub finished in natural color. The supporting platform is made of steel.

Trade Notes

Bryant Electric Company's Sales Department Personnel

The Bryant Electric Company of Bridgeport, Conn., has announced the personnel of its sales department as follows:

JOHN R. TOPPING, connected with the Chicago office for more than twenty years, is continued as assistant manager.

FRANK V. BURTON has been appointed general sales manager, a post just established. His connection with the company covers sixteen years, he having been Eastern sales manager for the last eleven years.

HAROLD E. SANDERSON, Pacific Coast manager at San Francisco, Cal., for the last eight years, continues in that capacity, but this office will now report direct to the general sales manager instead of being a subsidiary of Chicago.

ROBERT M. EAMES is appointed export manager, with headquarters at Bridgeport. He has been with the company for twelve years and for more than a year past has been devoting most of his attention to this department of the company's business.

WILLIAM A. STACEY, field representative of the company in the Middle West for the last ten years, becomes Western manager, succeeding to the vacancy caused by the death of Edward K. Patton, mention of which was made in the ELECTRICAL WORLD of March 30.

THE SUNDH ELECTRIC COMPANY, manufacturer of controlling devices, of New York City, announces a change of address from New York to Newark, N. J., the Newark address being Avenue C and Parkhurst Street, and the New York office 51 East Forty-second Street.

THE SHAWINIGAN ELECTRO-METALS COMPANY of Montreal, Can., maker of magnesium, has established a sales office in Cleveland, Ohio, with Detroit, Chicago, Buffalo, Pittsburgh and other points as tributary territory. D. P. Falconer, sales agent, has his office at 932 Leader-News Building.

THE NATIONAL BANK OF COMMERCE of New York City is distributing a new book entitled "Export Trade Associations." The publication contains the complete text of the Webb act, approved April 11, and an official summary of the report of the Federal Trade Commission on the development of foreign markets. Copies may be had on application.

THE WILLIAM F. WOLFF COMPANY of New York City has appointed the S. W. Electrical Company, 144 East Thirty-fourth Street, sole distributer of the "Anywhere" lamp brackets, under the management of William F. Wolff, effective May 1. The S. W. company intends appointing sales agents in the principal cities to handle wholesale and retail business.

THE GENERAL DEVICES & FITTINGS COMPANY has moved its office from 817 West Washington Street to the Mid-City Bank Building, Halsted and Madison Streets, Chicago. The factory will remain at the old location and will be enlarged to take in the space formerly occupied by the offices. This change was necessitated owing to the large increase in business.

THE BOSCH MAGNETO COMPANY of Plainfield, N. J., and Springfield, Mass., has been taken over by the government. A. Mitchell Palmer, alien property custodian, will name a new board of directors. It is officially announced that an investigation showed that the company was owned entirely in Germany. The real valuation of the property is said to be about $7,000,000, although it was capitalized at only $75,000.

HERBERT A. JACKSON has been elected president of the Chicago Pneumatic Tool Company of Chicago, to succeed W. O. Duntley, resigned. Mr. Jackson has for some time been connected with the Bethlehem Steel Corporation and was more recently head of its Boston office. He has had charge of the sales in that territory, and it is considered probable at Chicago that he will readjust the sales methods of the Chicago company.

THOMAS M. CLULEY, who has been associated with George W. Provost, president of the Union Electric Company, for the last twenty-two years, resigned his position on April 1 and joined the forces of the W. A. McCombs Company, Pittsburgh, Pa. The W. A. McCombs Company manufactures "Maco" safety switches. It is territorial representative of the following manufacturers: American Brass Company, American Circular Loom Company, Atlantic Insulated Wire & Cable Company, Delta-Star Electric Company and Page & Hill Company.

FRANK E. WATTS has gone into business for himself as manufacturer's agent at 30 Church Street, New York City. He will continue to represent the Hart Manufacturing Company, for which he has been New York district manager since the beginning of 1915, and in addition has taken on the lines of the following companies: Electric Fuseguard Company, Wadsworth Electric Manufacturing Company and Worth Manufacturing Company. His territory will cover Virginia, District of Columbia, eastern Maryland, Delaware, eastern Pennsylvania, New Jersey and New York State.

THE PHOENIX ELECTRIC COMPANY, Mansfield, Ohio, now occupies a new modern two-story brick building, fully equipped. A. C. Linzee, proprietor, secured possession of the plant about two years ago, going from Akron, Ohio, and having been designing engineer for the General Electric Company. He has developed a line of alternating-current motors, which will be manufactured on a large scale at the new plant. The increased business of the company made it necessary to secure new quarters and the new building is the result. The plant is fully equipped for the expansion of the business, which has had steady growth and during the past two years has nearly doubled.

Trade Publications

LAMPS.—A circular being distributed by the Waterbury-Wallace Company, Inc., describes the "Wallace" portable lamp.

STOKERS. — Laclede-Christy, Railway Exchange Building, St. Louis, has issued a new catalog describing and illustrating its chain-grate stokers.

ATTACHMENT PLUG. — The Mueller Electric Company of Cleveland, Ohio, is distributing a circular describing its "Attacho" plug for electric appliances.

LAMPS. — "A Light Which Beats Daylight" is the title of a paper by E. L. Elliott which is being distributed by the Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J.

BALL BEARINGS.—The Norma Company of America, 1790 Broadway, New York, has issued a circular describing its ball bearing for fractional horsepower motors. The various features of the ball bearing are given.

FUSES.—A. F. Daum of Pittsburgh, Pa., is distributing a circular describing and illustrating the Daum refillable cartridge fuse for electric light and power installation. The method of reloading the fuses is illustrated in the folder.

ELECTRIC HOUSE PUMPS. — The "Buckeye" electric house pump for cisterns and shallow wells is described in a bulletin distributed by Mast, Foos & Company of Pittsfield, Ohio. Illustrations of the pump are given and the construction features recounted.

BRASS FITTINGS. — The Ohio Brass Company of Mansfield, Ohio, has issued supplement No. 1 of its general catalog No. 16, describing and illustrating its brass fittings for electric railway and mine haulage construction. High-tension porcelain insulators are also described in the bulletin.

MECHANICAL RECTIFIERS.—The Breco Electric Company of Toledo, Ohio, is distributing a bulletin describing the Breco converter for rectifying alternating current. Converters for furnishing direct current to operate electric tools, etc., and for service stations and garages where large capacities are required are illustrated and described in the booklet.

FIBER AND PAPER INSULATION.—The National Fibre & Insulation Company, Yorklyn, Del., has issued a bulletin entitled "Vulcanized Fiber and Insulation Paper" that describes the "Old Hickory" fiber and "Peerless" insulation. The bulletin is illustrated with photographs showing the bushing, gear and gear blank and other products of the company. In the back of the booklet tables of useful formulas are presented.

BOWLS, GLOBES AND REFLECTORS.—The Ivanhoe-Regent Works of the General Electric Company, Cleveland, are distributing catalog No. 257, descriptive of the "Regent" bowls, globes and reflectors for commercial and ornamental illumination. Semi-indirect illumination for offices, schoolrooms and drafting rooms is discussed and general engineering data, including phonometric curves and detailed illumination curves for various lamps and reflectors, are given. Illustrations of the "Regent" shades and holders are included.

ELECTRICAL EQUIPMENT FOR CEMENT MILLS.—This is the title of a publication issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The pamphlet illustrates the interior of a motor-driven cement mill. Numerous photographic reproductions are given that show the application of motors to various types of machinery employed in cement mills. Advantages of motor drive for this class of service and characteristics required by motors to be specially successful are briefly discussed in the bulletin.

New Incorporations

THE ILLINOIS SOUTHERN POWER COMPANY of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Henry M. Brooks, Mack E. Gillis and P. L. Miller.

THE FRANCONIA ELECTRIC LIGHT & POWER COMPANY of Souderton, Pa., has been granted a charter with a capital stock of $5,000. S. F. Muzzy is interested in the company.

THE NEW ENGLAND ELECTRIC LAMP COMPANY of Danvers, Mass., has been chartered with a capital stock of $25,000. O. R. Bodwell is president and William A. Webb is treasurer.

THE OSKALOOSA (IOWA) POWER COMPANY has been incorporated with a capital stock of $5,000. The officers are: C. B. Vermillion, president, and Code M. Vermillion, secretary and treasurer.

THE SOUTHERN CITIES POWER COMPANY of Chattanooga, Tenn., has been incorporated by George B. Adams, G. W. Irwin, J. C. Stickney, J. H. Roymer and John R. Evans. The company is capitalized at $50,000.

THE ATTICA (IND.) ELECTRIC & SUPPLY COMPANY has been incorporated by J. W. Harrison, Charles W. Zeigler, John T. Nixon and Floyd E. Poston. The company is capitalized at $50,000 and proposes to generate and distribute electricity.

THE LEGAL LEVEL LIGHT COMPANY of Rochester, N. Y., has been chartered by D. T. Roach, I. Smith and T. B. Shanahan of Rochester, N. Y. The company is capitalized at $20,000 and proposes to manufacture automobile headlights, etc.

THE KANAWHA CENTRAL POWER & SUPPLY COMPANY of Olcott, W. Va., has been chartered with a capital stock of $100,000 to generate and distribute power. The incorporators are: S. B. Avis, Ivory C. Jordan, N. F. Young, John A. Thayer and F. A. Avis of Charleston.

THE AUTO ELECTRIC SERVICE COMPANY of Toronto, Ont., has been incorporated by George J. Beattie, 72 Victoria Street; Ivan R. Church, Rudolph P. Caulford and others. The company is capitalized at $40,000 and proposes to manufacture electrical apparatus, machinery, etc.

THE DOMINION LAND COMPANY of Montreal, Que., Canada, has been incorporated with a capital stock of $100,000 to manufacture electrical supplies, lamps, motors, engines, etc. The incorporators are: Philip H. Klein of Westmount, Que.; Henry B. Irving, Edson G. Place and others.

THE COMMONWEALTH PUBLIC SERVICE COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 to generate and distribute electricity. The incorporators are: M. M. Clancy, C. L. Rimlinger and F. A. Armstrong of Wilmington, Del.

THE UNILECTRIC COMPANY OF CANADA, LTD., of Edmonton, Alta., Canada, has been incorporated with a capital stock of $25,000 to manufacture electrical supplies, equipment, motors, etc. The incorporators are: Chester McMann, Joseph R. Ulery of Edmonton, Godfrey H. Beaudry of Wainwright, and others.

THE INTERURBAN ENGINEERING COMPANY of Toronto, Ont., has been incorporated by Edwin Smily, 17 Thornburn Avenue, Toronto; Bruce Williams, Bank of Hamilton Building; Wesley Rhodes and others. The company is capitalized at $35,000 and proposes to manufacture machinery, motors, electrical apparatus, etc.

THE GREAT WEST ELECTRIC COMPANY of Winnipeg, Man., has been incorporated with a capital stock of $300,000 by Sidney T. Smith, William R. Ingram, James N. Hutchison and others. The company proposes to generate and distribute electricity for lamps, heaters and motors; also to manufacture electrical equipment.

New England States

BATH, ME.—The Central Maine Power Company is extending its feed wires from a plant near the Chops to the pumping station at Nequasset, which is to be equipped for electrical operation soon.

CAVENDISH, VT. — Negotiations have been completed between the Colonial Power & Light Company of Claremont, N. H., and the Cavendish Electric Power Company whereby the former will supply electricity (100 kw.) to the latter. Plans have been prepared for the construction of a new substation.

HARTFORD, VT. — Preliminary plans have been prepared by the New England Telephone & Telegraph Company, 50 Oliver Street, Boston, Mass., for the construction of a new telephone exchange building at Gates and Currier Streets, in the White Junction district of Hartford.

BROCKTON, MASS.—Work will soon begin on the installation of the ornamental lighting system on Main Street, in the business center, School and Centre Streets, and City Hall Square. Orders have been placed for the material for the proposed work.

FALL RIVER, MASS.—The Fall River Electric Light Company has petitioned the Massachusetts Board of Gas and Electric Light Commissioners for permission to issue $700,000 in capital stock, the proceeds to be used for erecting an electric transmission line to connect the company's plant at Fall River with the wires of the New England Power Company and for enlarging the Hathaway Street plant.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company is installing a 300-kw. generator at the station of the Worcester Suburban Electric Company for the purpose of supplying electricity to its line between Uxbridge and Milford.

NEWBURYPORT, MASS.—Plans are being considered for the construction of an addition to the new electric plant of the Newburyport Gas & Electric Company on the former Fiberloid wharf, to provide space for the installation of a 2000-kw. electric generating unit, with a condenser pump, boilers and other apparatus.

NEW BEDFORD, MASS. — The City Council is considering some changes in the ornamental lighting system on Purchase Street. It is proposed to erect the type of lamp used on Washington Street south to School Street and north of Maxfield Street, calling for the installation of 23 additional lamps. Nothing will be done until the end of the war. William P. Briggs, superintendent of street lights, was instructed by the Council to prepare and submit a sketch for a lighting scheme for Acushnet Avenue from Ball's Corner to Belleville Road.

TAUNTON, MASS. — The special committee appointed to look into the needs of the municipal electric-light plant has engaged C. W. Whiting of Boston, consulting engineer, to advise the City Council and the management as to the condition of the plant and what is needed to put it in a position to meet the demands of increasing business.

HARTFORD, CONN.—A permit has been granted to the Arrow Electric Company for the construction of a factory, 55 ft. by 135 ft., three stories high, on Hawthorn Street, to cost $55,000. W. J. Sexton has the contract for building. Ford, Buck & Sheldon are architects.

NEW HAVEN, CONN.—The United Illuminating Company has been granted a permit for the construction of an addition to its plant on Grand Avenue, to cost about $6,000.

NORWALK, CONN. — The ornamental lighting system on South Main Street will be extended as far as Monroe Street soon.

STAMFORD, CONN. — Plans have been prepared by the Stamford Electric & Manufacturing Company for further extensions to its plant. The company manufactures electric motors and has recently completed the erection of a large two-story factory. It is proposed to build another similar building and to make extensions to the present building.

Middle Atlantic States

BUFFALO, N. Y. — The Transmission Ball Bearing Company, 1050 Military Road, Buffalo, is considering the erection of an addition, 175 ft. by 350 ft., to its plant, to cost about $150,000.

DUNKIRK, N. Y.—The Council has appropriated $7,000 for the purchase of ornamental street lamp fixtures, the cost of the installation and maintenance to be met by the water board. The type of lamp has not yet been decided upon.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ELMIRA, N. Y.—The Public Service Commission has directed the Elmira Water, Light & Power Company to erect an electric transmission line to Moutour Falls and to supply electricity to residents in that village.

GLENS FALLS, N. Y.—The Adirondack Electric Power Corporation is planning to construct a power house at Glens Falls, to cost about $100,000. The company is also contemplating the construction of a power station in the vicinity of Schoharie later on.

GROTON, N. Y. — The Groton Electric Power Company has petitioned the Public Service Commission for permission to construct an electric-light plant in Groton and for an approval of franchise granted by the village.

LONG ISLAND CITY, N. Y. — A. J. Buschmann Company, 461 Eighth Avenue, New York, has been awarded contract for all electrical work in connection with the new addition to the plant of the Welin Marine Equipment Company, 312 Vernon Street, now under construction. The cost of the building is estimated at $25,000.

NEW YORK, N. Y.—The capital stock of the A. L. Shemel Company, 60 East 116th Street, has been increased from $30,000 to $75,000. The company manufactures electrical supplies.

ROCHESTER, N. Y.—Contract has been awarded to A. Frederich & Sons Company, 710 Lake Avenue, Rochester, by the Board of Contract and Supply for the construction of a new power plant.

ROCHESTER, N. Y. — Preparations are being made by the Mayer Coating Machine Company of Rochester for the erection of a factory, 2 miles outside of the city limits. The company, it is reported, is in the market for equipment for an automatic steam engine plant. The company manufactures paper-coating machinery.

GLOUCESTER CITY, N. J.—Plans are being considered by the Public Service Electric Company for the installation of a new conduit system, for electric wires, in Market Street, beginning at its local power house and extending to King Street. The City Council has granted the company permission to install the system.

MORRISTOWN, N. J.—The installation of new motor equipment in the local schools for operating the ventilating system is under consideration by the board of education.

NEWARK, N. J.—Plans have been prepared by the Natural Carbonic Gas Company, McClellan Street, for the construction of a boiler plant, to cost about $10,000.

NEWARK, N. J.—Bids will be received by the Board of Freeholders for the installation of a new water tube boiler at the Essex County Hospital at Overbrook. Thomas W. Smith is chairman of the committee on public buildings.

NEWARK, N. J.—The Northern Leather Works & Produce Company, 377 Broadway, New York City, has awarded contract to H. W. Franklin, 110 Fort Greene Place, Brooklyn, N. Y., for the construction of a new power house at its local plant on Backus Street.

RAHWAY, N. J. — The National Pneumatic Company, 50 Church Street, New York City, is contemplating the construction of a new building, 200 ft. by 300 ft., on New Brunswick Avenue, Rahway, which will be equipped as a machine shop and for general manufacturing purposes.

WEEHAWKEN, N. J.—Plans are being considered by the Weehawken Tungsten Lamp Company, 550 Gregory Avenue, for the reconstruction of its brick and iron lamp manufacturing plant, recently destroyed by fire, causing a loss of about $25,000.

ALTOONA, PA.—The Penn Central Light & Power Company has filed notice with the Public Service Commission of an issue of $75,000 in bonds, the proceeds to be used for extensions and improvements to its plant and system.

GREENVILLE, PA. — Notice has been filed with the Public Service Commission by the Mercer County Light, Heat & Power Company of an issue of bonds to the amount of $100,000, the proceeds to be used for extensions, improvements, etc.

HAZLETON, PA.—Plans have been completed for equipping the Oneida slope of the Lehigh Valley Coal Company of Hazleton for electrical operation. Energy to operate the mine will be supplied by the Harwood Electric Company of Hazleton.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia & Reading Railroad Company for the construction of a new power house, 45 ft. by 75 ft., at Tulip and Somerset Streets.

PHILADELPHIA, PA.—Plans are being prepared by the Bell Telephone Company for additions and improvements to its telephone building in Germantown. John T. Windrim, Commonwealth Building, is architect.

WILLIAMSBURG, PA.—Notice has been filed with the Public Service Commission by the Penn Central Power & Transmission Company of an issue of $50,000 in bonds, the proceeds to be used for extensions and improvements to its system.

WILMINGTON, DEL.—The turbine room at the plant of the Wilmington Gas Company, foot of Madison Street, was recently destroyed by fire, causing a loss of about $25,000.

WILMINGTON, DEL.—Notice has been filed with the Public Service Commission by the National Electric Service of a change in its name to the Brokaw-Eden Manufacturing Company, and an increase in capital stock from $500,000 to $1,000,000.

FREDERICK, MD.—The Hagerstown & Frederick Railway Company has submitted a plan to the Mayor and Aldermen for lighting the streets of Frederick. Two proposals were submitted, the city to have the option of taking either, under a contract for one, two or three years, or practically any time it sees fit, the contract to be terminated upon a notice of a certain length of time. The first is to light the city at a cost not to exceed $7,200 per year, exclusive of the College Park, and not to exceed $7,500 per annum, including College Park. The other is for the city to learn the cost of operating the municipal plant from April 1, 1917, to April 1, 1918, and no matter what this amount might be the company would guarantee to furnish the service for the same figures, less $2,000. It is not proposed to dismantle the municipal plant. The plans provide for the installation of a motor in the city plant and to utilize energy from the plant at Security and water power at Dam No. 5.

PARKERSBURG, W. VA.—The Parkersburg Iron & Steel Company has begun work on the construction of an addition to its power plant, 30 ft. by 45 ft., to cost about $12,000.

WILCOE, W. VA.—The Norfolk & Western Railroad Company is planning to rebuild its machine shop in Wilcoe, recently destroyed by fire.

NORFOLK, VA.—Plans have been filed and contract awarded to Nicholas & Linderman, Seaboard Bank Building, Norfolk, for alterations and improvements to its electric substation, to cost about $11,000.

RICHMOND, VA.—The capital stock of the Williams Power Company has been increased from $50,000 to $150,000, the proceeds to be used for extensions and improvements.

RICHMOND, VA. — Hackley Morrison, Moore Building, 16 North Ninth Street, Richmond, Va., it is reported, would like to receive prices (dealers') on a 75-kw., 125-volt direct-current generator, directly connected to generator; could use a turbo-generator of same rating.

WASHINGTON, D. C.—The United States Shipping Board, 1319 F Street, N. W., is planning to erect a five-story building, to have 500,000 sq. ft. of floor space, for which $5,000,000 has been appropriated.

WASHINGTON, D. C. — Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of substation and frequency-changer house to the Dawson Construction Company, May Building, Pittsburgh, Pa., at $52,520.

WASHINGTON, D. C. — Contract has been awarded by the Chesapeake & Potomac Telephone Company, Thirteenth and G Streets, N. W., to Andrew Murray, 729 Twelfth Street, N. W., Washington, for remodeling its exchange buildings at 1420 Columbia Road and at 629 B Street, to cost $60,000 and $15,000 respectively; and also for a third exchange building at another location.

WASHINGTON, D. C.—The contract for construction of the building for the Washington Athletic Club is reported to have been awarded to the Longacre Construction Company, Widener Building, Philadelphia, Pa. The building will be 138 ft. by 150 ft., 12 stories high, and will cost about $650,000. Milburn, Heister & Company, Union Savings Bank Building, Washington, are architects.

North Central States

DETROIT, MICH.—The Detroit United Railway Company is planning to build an extension to the Ford plant on the River Rouge.

GRAND RAPIDS, MICH. — The Lewis Electric Company of Grand Rapids has been awarded a contract for the installation of lamps and motors in the new Haskelite plant near Fulier Station. The contract calls for wiring and the installation of 350 nitrogen lamps of 350 cp. each and 35 Wagner motors.

BYRAN, OHIO.—Improvements are contemplated to the municipal electric-light plant and water-works system, involving an expenditure of about $40,000.

CLEVELAND, OHIO.—The capital stock of the North Electric Company has been increased from $135,210 to $210,000.

COVINGTON, OHIO.—The capital stock of the Buckeye Light & Power Company has been increased from $40,000 to $60,000.

DAYTON, OHIO.—Resolutions have been adopted by the City Council providing for the installation of an ornamental lighting system on East Second Street between Jefferson and St. Clair Streets

IRONTON, OHIO. — The Ironton Incandescent Light & Supply Company is contemplating building an addition to its plant at First and Chestnut Streets.

LORAIN, OHIO. — The American Ship Building Company is erecting a large power house in connection with extensions to its plant, which include a new boiler shop, machine shop and other new departments. The cost of the power house is estimated at $200,000.

MANSFIELD, OHIO.—The capital stock of the Richland Public Service Company has been increased from $10,000 to $3,200,000.

NELSONVILLE, OHIO. — The Hocking-Sunday Creek Traction Company is planning to build a new substation. A new rotary converter, it is reported, has been purchased by the company.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company has entered into a contract with the Erie Window Glass Company for an initial installation of electrical power, which will ultimately lead to larger demand for electricity.

SHELBYVILLE, KY.—Surveys are being made by the Frankfort & Shelbyville Traction Company for the construction of its proposed electric railway between Frankfort and Shelbyville, a distance of about 20 miles. Pending the construction of its own power plant the company will purchase energy to operate the system from a nearby central station. L. G. Smith of Shelbyville is president.

EVANSVILLE, IND.—The capital stock of the Schroeder Headlight & Generator Company has been increased from $150 000 to $250.000. The company has taken over the plant of the L. B. Jones Company of Kansas City. Mo., manufacturers of farm electric plants.

INDIANAPOLIS, IND.—The Ross Power Equipment Company, Merchants' Bank Building, Indianapolis, it is reported, would like to receive prices (dealers') on a 250-kva., 240/440-volt, 60-cycle, three-phase engine type generating unit, for 125-150 lb. steam. 3 to 5 lb. back pressure; also one 400-kva. generating unit, same as above; one 150-kw., 250-volt compound generating unit, directly connected; one 250-kw. and one 500-kw., either simple or tandem, compound engine.

CHICAGO, ILL. — The plans are being prepared by the International Harvester Company, South Michigan Avenue, for the construction of a series of foundry buildings on Rockwell Street, to cost about $500,000.

GILLESPIE, ILL.—The Illinois Traction System has secured contract to supply electricity to operate the machinery in the new coal mine being developed in Gillespie. The company will also transport coal mined from the new shaft.

SPRINGFIELD, ILL. — The Springfield Light, Heat & Power Company has applied to the State Utility Commission for permission to issue $100,000 in bonds, the proceeds to be used for extension to mains and service and the purchase of boilers and mechanical equipment.

TUSCALO, ILL.—The board of education is considering the construction of a heating plant in connection with the high school building.

BRODHEAD, WIS. — Bids will be received by the Electric Light and Water Commission, Brodhead, until April 30, for improvements to the municipal hydroelectric plant, including the installation of a new water power unit, with all appurtenances, to cost about $35,000.

FAIRWATER, WIS.—The Joint District No. 4, Metomen, Fond du Lac County, has voted to build a new high school, with a manual training department, the cost not to exceed $35,000, in the village of Fairwater. B. E. Mehner of Fond du Lac is architect.

MILWAUKEE. WIS.—The Ansted Leather Company, 560 Commerce Street, is contemplating the installation of an additional steam-driven electric generating unit of 150 capacity and 16 electric motors aggregating 165 hp. The cost is estimated at $10,000.

MILWAUKEE, WIS.—Plans have been completed by the Milwaukee Paper Box Company, 400 Florida Street, for the construction of a manufacturing plant, 120 ft. by 145 ft. The cost, including machinery, motor and other equipment, is estimated at $200,000. William C. Carlson is president and treasurer. Schenectzky & Son, 712 Germania Building, architects, are taking bids for the above works.

OREGON, WIS.—Bids are being asked by C. A. Hanan, village clerk, for a 175-gal. centrifugal pump and an auxiliary suction pump with a 220-volt motor, starter, etc.

IVANHOE, MINN.—Bids will be received by Karl A. Hansen, county auditor, court house, Ivanhoe, until May 6, for the construction of the Lincoln County court house at Ivanhoe, separate bids to be submitted on general construction, heating and ventilation, plumbing and electric work. Plans and specifications may be obtained at the above office or at the office of James A. Burner Company, architects, 554 McKnight Building, Minneapolis, Minn.

STILLWATER, MINN. — The Northern States Power Company (Stillwater division) is erecting an electric transmission line to furnish electricity to the plant of the Twin City Forge & Foundry Company in Stillwater. The Twin City company is building docks at its plant here.

HUMBOLDT, IOWA.—Bids will be received by the board of directors of the Independent School District of Humboldt until May 3 for construction of high and grade school building. Separate bids to be submitted on general construction, heating and ventilating, plumbing electrical work, seating and equipment. Plans may be obtained at the office of G. L. Lockhart. Endicott Building, St. Paul, Minn., and Youngerman Building, Des Moines, Iowa, upon deposit of $5.

RED OAK, IOWA.—The Red Oak Electric Company has applied to the Board of County Supervisors for a franchise to erect and operate electric transmission lines on certain roads in Pleasant Township for a period of 20 years.

KANSAS CITY, MO.—The Kansas City Railways Company, it is reported, has purchased 20 underfeed stokers, two boiler feed pumps. one locomotive crane and one feed water heater.

KANSAS CITY, MO. — The Kewanee Boiler Company, 1420 McGee Street, is contemplating the purchase of a hand-power or electrically-operated traveling crane on track similar to locomotive type with a capacity of 20,000 lb.

ST. LOUIS MO.—Three warehouse units will be erected by the United States War Department, Second and Arsenal Streets, instead of one as originally planned. The buildings will be 600 ft. by 100 ft., six stories high, and will cost about $1,200,000. Further information may be obtained from Major James R. Fordyce of the St. Louis quartermaster's department.

BRADLEY, S. D.—The Dakota Northern Power Company is contemplating the erection of a new power plant and the installation of a 300-kw. reciprocating unit, the equipment to be purchased within 30 days. E. H. Lewis is secretary.

VERMILION, S. D. — The proposal to issue $20,000 in bonds for the construction of a city building, in which to house the equipment of the municipal lighting plant, provide offices for the city officials and quarters for the volunteer fire department, will soon be submitted to the voters.

CARROLL, NEB. — At an election held recently the proposal to issue $9,500 in bonds for the installation of an electric-lighting system in Carroll was carried.

FIRTH, NEB.—Bids, it is understood, are being asked for extensions to the electric-lighting system. For further information address J. S. Kallemyn.

HEARTWELL, NEB. — Bonds to the amount of $2,700 have been voted for the installation of an electric-lighting system in Heartwell.

EDGERTON, KAN.—The installation of an electric-lighting system in Edgerton is reported under consideration. Energy to operate the proposed system may be secured from the Wellsville-Gardner electric transmission line.

LEONARDVILLE, KAN. — The Riverside Light & Power Company of Abilene is contemplating extending its service to Leonardville. A street-lighting system, consisting of 20 lamps, will be installed, which will probably be followed by ornamental lamps.

PERU, KAN. — The installation of an electric-lighting system in Peru is reported to be under consideration.

WICHITA, KAN.—The construction of an electric interurban railway from Wichita to Arkansas City, via Derby, Mulvane, Belleplaine and Winfield, is under consideration. John Madden and W. I. Funk are reported interested in the project.

WINCHESTER, KAN. — The Automatic Electric Light Company is contemplating the construction of an electric-light and power plant near Wincnester.

Southern States

CHAPEL HILL, N. C.—Bids will be received by Edward K. Graham, president of the University of North Carolina, until May 7, for the construction of the Physics-Engineering Building. Plans and specifications may be obtained at the office of Charles C. Hook, architect, Charlotte, upon deposit of $15.

GREENSBORO, N. C. — Contract has been awarded to J. T. Salmon of Durham for the erection of the east wing of the McIver Building for academic building, 65 ft. by 110 ft., at $68,546; steam heat from central plant, $8,000; conduit lighting system, $1,450; also for construction of dormitory, 49 ft. by 158 ft., at $84 500; steam heat from central plant, $13,000; conduit lighting system (exclusive of fixtures), $2,200. Harry Barton of Greensboro is architect. For further information address Dr. J. I. Foust, president of the college.

ROCK HILL, S. C.—Plans have been prepared by Edwards & Sayward of Atlanta, Ga., for the construction of a students' social and activity building and a dormitory, to cost $125,000 and $100,000 respectively. Bids will be asked for construction of buildings in from 60 to 90 days.

ATLANTA, GA.—The election which was to have been held on March 25 has been postponed by the City Council until May 26, when the proposal to issue the following bonds will be submitted to the voters: For electric generating plant, $75,000; waterworks pumping station, $300,000; cyclorama building, $100,000, and fire department, $175,000.

REIDSVILLE, GA.—The proposal to issue $10,000 for the installation of an electric-lighting system in Reidsville is under consideration.

SAVANNAH, GA.—The Chatham County Traction Company has recently been granted a charter to build an electric railway from a connection with the street railway system of the Savannah Electric Company in Savannah to Port Wentworth. The company is capitalized at $150,000. H. C. Foss, manager of the Savannah Electric Company, is interested in the company.

JACKSONVILLE, FLA. — Plans are being prepared to establish a plant in the Jacksonville ship-outfitting yard of the California Brick Company to install machinery in ship hulls. The plans provide for the erection of machine, blacksmith, coppersmith, paint and electrical shop, garage, storerooms, 11-room office, etc., to cost about $50,000, also installation of 50-ton and 10-ton traveling cranes. Machinery for the proposed plant, it is understood, has been purchased. The work will be done by the company's own force. It has a contract to furnish and install mechanical equipment in twenty 3500-ton wooden vessels of the Emergency Fleet Corporation owned by the United States government. John Clarence Temple of Jacksonville is general manager.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company is contemplating extensions to its power plant, including the installation of a 500-hp. Heine water tube boiler and turbine-driven feed pump. This equipment, it is understood, has been purchased.

ENSLEY, ALA.—The Southern Bell Telephone Company is contemplating building an addition to its telephone exchange on Nineteenth Street, between F and G Streets, to cost about $17,500.

HUNTSVILLE, ALA. — Plans are being considered by Miller Brothers for the reconstruction of its cotton gin, recently destroyed by fire. The gin will be operated by electricity.

LITTLE ROCK, ARK. — The Mutual Motors Company is contemplating the installation of a complete shop, new equipment including a lathe with 8-in. to 12-in. swing, 20-in. back-geared drill press, electrical equipment, air compressor, portable crane, small tools, etc.

RECTOR, ARK.—Plans are being prepared by Luther King for the construction of a new power house to operate a new gin house and cotton house now being built.

NEW ORLEANS, LA.—The construction of an electric railway between New Orleans and Mobile, Ala., is reported under consideration.

NEW ORLEANS, LA.—Preparations are being made to establish a vocational school for shipbuilding, repairing, etc., in New Orleans, involving an expenditure of from $272,000 to $317,000 for buildings and equipment, which will include the construction of four buildings, consisting of administration and auditorium with 6000 sq. ft. Provision will be made for training in foundry and machine work, electrical construction, carpentry, etc. J. A. Pratt, president.

GOTEBO, OKLA.—The City Council is planning to rebuild the municipal electric-light plant recently destroyed by fire.

SAVANNA, OKLA.—The Savanna Lighting & Milling Company, recently incorporated with a capital stock of $2 000, it is reported, is contemplating the installation of a lighting plant in Savanna.

STONEWALL, OKLA. — The Oklahoma Power & Transmission Company is contemplating extending its electric transmission lines to Stonewall to supply electrical service here.

BEAUMONT, TEX. — Bids will be received by J. G. Sutton, city secretary, until May 7 (extension of date) for general construction, heating, plumbing and wiring for additions to Ogden, Fletcher and Magnolia schools. The total cost is estimated at $100,000. Plans and specifications are on file at the office of Sanguinet, Staats & Gottlieb, architects, at Fort Worth and Houston.

CARTHAGE, TEX.—Plans are being considered by F. T. Rembert and K. S. Melton of Longview for the installation of an electric-light plant and ice factory in connection with the Carthage Cotton Oil Company's plant.

CLYDE, TEX.—The installation of an electric-light and power plant in Clyde is under consideration. Robert Cook is reported interested in the project.

NIXON, TEX.—The Nixon Electric Light & Power Company, recently incorporated with a capital stock of $12,000, is contemplating the construction of an electric-light and power plant in Nixon.

RIO GRANDE, TEX.—The capital stock of the Rio Grande Ice, Water & Light Company has been increased from $24,000 to $30,000.

ROUND ROCK, TEX.—Preparations are being made by S. E. Bergstrom of Kerens for the installation of an electric-light plant in Round Rock. Machinery, it is understood, has been purchased.

Pacific and Mountain States

COLVILLE, WASH.—The Stevens County Power & Light Company of Colville has petitioned the Commissioners of Stevens County for a franchise to erect an electric transmission line over the public roads in Stevens County.

SEATTLE, WASH. — The Puget Sound Traction, Light & Power Company is contemplating improvements to its power house at 6600 Fourteenth Avenue South, including the installation of a coal conveyor, concrete tunnels and hopper.

TACOMA, WASH.—At an election held April 16 the proposal to issue $4,000,000 in bonds for the construction of the proposed additional power plant was defeated.

COLUSA, CAL.—The Colusa Land & Water Company, it is reported, is contemplating the development of electricity for agricultural purposes. The proposed work will include a main canal, 8.7 miles long, a pumping plant, equipped with one 42-in. pump having a capacity of 100 sec.-ft., driven by a 400-hp. motor, and two 26-in. pumps with a capacity of 50 sec.-ft. each, driven by a 200-hp. motor. The cost of the project is estimated at $219,890.

LOS ANGELES, CAL.—A resolution has been introduced in the City Council providing for the use of electricity from the municipal electric plant for the new Broadway lighting system.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has been instructed by the Board of Public Utilities to double-track its car line between Wilmington and Long Beach immediately.

LOS ANGELES, CAL.—The Public Service Commission has awarded the contract for laying of the submarine cable across the channel in the harbor to serve the substation to be erected at Fish Harbor, which will furnish electrical service to the proposed plant of the Southwestern Shipbuilding Company.

LOS ANGELES, CAL.—Plans are being considered by the power bureau for the installation of two submarine cables across the main harbor channel from the foot of Fifth Street in the San Pedro district to serve the city power substation, to be erected near Fish Harbor, which is to furnish energy to the shipbuilding plant.

MONTEREY, CAL. — The City Council has authorized the city engineer to prepare plans for extending the electrolier street-lighting system on Main Street from Scott Street north toward Decatur Street.

ONTARIO, CAL.—The San Antonio Water Company of Ontario is contemplating the construction of a new electric power house in San Antonio Canyon. Glenn D. Smith is manager.

RICHMOND, CAL. — The City Council has voted $12 000 for electrical equipment for the municipal wharf, now under construction. Contracts have been awarded for two electric trucks, at a cost of $4.383, to the United Vehicle company and for a 5-ton electric crane to the Cyclops Iron Company, at $7.500.

ROUND MOUNTAIN, CAL.—The development of a hydroelectric power plant at a drop near Round Mountain is reported to be under consideration by Wilbur O. Lusk of Los Angeles. The plans provide for the construction of a ditch and pipe line, 6½ miles long. It is estimated that 7500 kw. can be developed.

SAN FRANCISCO, CAL.—The contract for electrical work in connection with the yard work at the southeast wing of the San Francisco Hospital has been awarded to J. Burtchaell, 357 Ellis Street, at $4,975.

PUEBLO, COL. — The Arkansas Valley Railway, Light & Power Company has recently completed an extension of its transmission lines to the Outland Ranch, and has accepted a contract to extend its lines to other ranches in that vicinity.

Canada

NEW WESTMINSTER, B. C. — The Campbell River Lumber Company has recently installed a step-down transformer station to convert the high-tension current of 12,000 to 2200 volts. The amount of energy used in the mill is about 950 hp.

HAMILTON, ONT.—Plans are being prepared by the Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., for the construction of a new plant at Old River at its junction with the Baltimore & Ohio Railroad for the Hamilton & Rossville Hydraulic Company on land which has been given the company in exchange for its present quarters. The company has been obliged to change its location owing to the flood prevention work by the Miami Conservancy District. The plans provide for the installation of three generating units of 800 kw. each.

SUDBURY, ONT. — Bids will soon be asked by W. J. Ross, clerk, for one electrically-driven pump of 12.000 gal. capacity, and one 175-lb., two-phase, 220-volt alternating-current induction motor.

MONTREAL, QUE. — The Ferro Alloy Company, it is reported, is planning to build a plant on the St. Maurice River in the Province of Quebec to secure the advantages of the cheap water power there.

SHAWINIGAN FALLS, QUE.—Plans are under consideration, it is reported, for the installation of three additional units of 20,000 hp. each in plant of the Laurentide Power Company, increasing the output to 180,000 hp. J. E. Aldred, 24 Exchange Place, New York, N. Y., is president of the company.

Miscellaneous

HAVANA, CUBA.—Contracts have been placed by the Havana Electric Railway, Light & Power Company for equipment for railway substations, consisting of two 2000-kw. rotary converters, six-phase, 60 cycles, 450 r.p.m.; six 750-kva., single-phase, oil-insulated, self-cooled transformers, 13,200 volts to rotary voltage; also switch and control equipment, to the Westinghouse Electric & Manufacturing Company.

(Issued April 9, 1918.)

1,261,771. MOTOR-CONTROLLED BRAKE; John S. Coldwell, Milwaukee, Wis. App. filed March 19, 1917. Improvements.

1,261,772. SYSTEM FOR SIGNALS AND MOTOR CONTROL FOR ELECTRIC ROADS; Roy V. Collins, New York, N. Y. App. filed May 13, 1913. Improvements.

1,261,777. OVERLOAD SWITCH; James K. Delano, Jr., Louisville, Ky. App. filed March 8, 1915. For use on low-voltage work.

1,261,790. CIRCUIT - CONNECTOR SWITCH; Harry A. Douglas, Bronson, Mich. App. filed Aug. 23, 1917. Improvements.

1,261,817. ELECTRICAL SYSTEM AND APPARATUS THEREFOR; John W. Jepson, New York, N. Y. App. filed Oct. 2, 1908. For voltage regulation.

1,261,856. SUPPORTING MECHANISM; Thomas B. Rule, Arklow, Ireland. App. filed Aug. 17, 1916. Supports an electric lamp.

1,261,870. ELECTRIC TRANSMITTING SYSTEM; Olof A. A. Tenow and Erik G. Ahnstrom, Stockholm, Sweden. App. filed Dec. 29, 1916. Remote control.

1,261,874. ELECTRIC FITTING; Samuel B. Van Hanst, Syracuse, N. Y. App. filed Feb. 19, 1910. Conduit fitting for use as a receptacle for snap switch.

1,261,884. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Lionel M. Wolffsohn, Hoboken, N. J. App. filed March 18, 1916. Improvements.

Record of Electrical Patents

Notes on United States Patents

1,261,891. ARC-LIGHT CARBON; Hertha Ayrton, Hyde Park, London, England. App. filed Sept. 28, 1914. Improvements.

1,261,906. ELECTROMAGNETIC REGULATOR; John A. Coleman, Cleveland, Ohio. App. filed April 8, 1916. For operating valves and dampers.

1,261,928. ELECTRIC - LAMP INSTALLATION; Monroe Guett, Hartford, Conn. App. filed April 5, 1917. Lamp socket connected into the electrical circuit is inaccessible for the purpose of the insertion or removal of a lamp.

1,261,943. PLATE - WELDING PROCESS AND ARTICLE; Walter B. Lasher, Bridgeport, Conn. App. filed May 31, 1917. Welds thin plates.

1,261,968. MAIL - DISTRIBUTING SYSTEM; Simon B. Storer, Syracuse, N. Y. App. filed Dec. 11, 1914. Improvements.

1,261,971. ELECTRIC RIVETING MACHINE; Albertis C. Taylor, Warren, Ohio. App. filed Sept. 19, 1916. Improvements.

1,261,975. HALL-BUTTON CUT-OUT SWITCH; Clarence W. Wheeler, Chicago, Ill. App. filed May 21, 1915. For automatic electric elevators.

1,261,999. DYNAMO - ELECTRIC MACHINE; Ernest J. Andrews, Chicago, Ill. App. filed June 11, 1912. For starting internal-combustion engines.

1,262,000. BATTERY METER; William Anthony, Clyde, Ohio. App. filed June 4, 1917. For measuring the energy or electromotive force of batteries.

1,262,019. VOLTAIC CELL; Miller E. Conrad, Atlantic, Iowa. App. filed Feb. 7, 1917. Improved depolarizing cell.

1,262,020. VOLTAIC CELL; Miller E. Conrad, Atlantic, Iowa. App. filed Feb. 7, 1917. Improved depolarizing cell.

1,262,037. TROLLEY RETRIEVER; Charles E. Gierding, Mansfield, Ohio. App. filed March 19, 1914. Improvements.

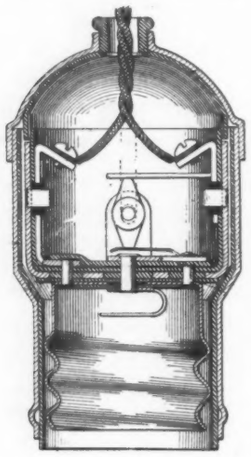
1,262,045. ELECTROLYTIC APPARATUS; James B. Herreshoff, Jr., Richmond Hill, N. Y. App. filed Dec. 4, 1915. For use in refining.

1,262,072. ELECTRICAL APPARATUS FOR HEATING STILLS, BOILERS AND THE LIKE;

Charles O. Lorenz, Port Arthur, Tex. App. filed May 8, 1917. Heating element not affected by repeated changes in temperature.

1,262,080. Electric Starter; Albert H. Midgley, Acton Vale, England. App. filed July 10, 1915. For internal-combustion engines.

1,262,088. Spark-Plug Tester; Alonson D. Perkins, New York, N. Y. App. filed May 10, 1916. For determining if the electric circuit of a spark plug has been accidentally broken without requiring the plug to be removed from the engine.



1,262,237—Incandescent-Lamp-Bulb Socket

1,262,103. Apparatus for Testing Cables; Edmund O. Schweitzer, Chicago, Ill. App. filed Feb. 1, 1912. For fault or ground.

1,262,112. Telephone System; Frank M. Slough, Elyria, Ohio. App. filed May 15, 1915. Improvements.

1,262,113. Telephone System; Frank M. Slough, Elyria, Ohio. App. filed July 26, 1915. Improvements.

1,262,128. Trolley Retriever; William C. Starkey, Mansfield, Ohio. App. filed Nov. 21, 1914. Improvements.

1,262,141. Electric Incandescent Lamp; Edward Terry, Brixton, London, England. App. filed Oct. 2, 1915. Filament renewable.

1,262,148. Electric Tool; Alex Wendelburg, New York, N. Y. App. filed Sept. 4, 1913. Operating means for the tool-driving motor.

1,262,149. Controller for Electric Hammers; Alex Wendelberg, New York, N. Y. App. filed Aug. 26, 1914. Means for delivering current to the operating coils of the hammer at predetermined time intervals.

1,262,150. Method of and Apparatus for Controlling a Circuit; Paul R. Werner, Philadelphia, Pa. App. filed Oct. 13, 1915. Saturated magnetic field is fully developed before the movement of the armature takes place.

1,262,155. Terminal Connector for Electrical Conductors; Otto Zimmerman, New York, N. Y. App. filed July 15, 1916. Double-eyelet type for flexible electric conductors.

1,262,173. Apparatus for Neutralizing Static Electricity; William H. Chapman, Portland, Me. App. filed April 21, 1917. Removal of static electricity from paper, fabrics and other material in process of manufacture.

1,262,187. Controlling Switch for Synchronous Motors, Rotary Converters and Synchronous Rectifiers; James K. Elderkin, Jr. App. filed July 30, 1914. Starts motors so as always to synchronize with the fields excited at the same polarity.

1,262,198. Magneto-Generator; Edward B. Jacobson, Springfield, Mass. App. filed March 13, 1915. Operating parts effectively housed from dust and dirt.

1,262,228. Storage-Battery Separator; William Morrison, Chicago, Ill. App. filed Feb. 20, 1918. Sheet of wood impregnated with barium sulphate.

1,262,233. Electromagnetically Operated Device; Ethelbert T. R. Murray, Radlett, and George F. Shotter, Streatham, London, England. App. filed March 23, 1916. Relay in which the current necessary to operate the device can be varied by changing the length of the air gap.

1,262,234. Circuit Breaker; Ethelbert T. R. Murray, Radlett, and George Frederick Shotter, Streatham, London, England. App. filed March 24, 1916. Improvements.

1,262,237. Incandescent-Lamp-Bulb Socket; Charles A. Nelson, Chicago, Ill. App. filed May 22, 1914. The use of blocks or masses of porcelain, hard rubber, etc., is eliminated.

1,262,248. Apparatus for the Electrolytic Production of Copper and Other Metals; Marcel Perrer-Lloyd, Boulogne-sur-Seine, France. Improvements.

1,262,257. Motor Controller; Harrison P Reed and Walter C. Kennedy, Milwaukee, Wis. App. filed March 1, 1915. Field-controlling means for motors having shunt-field windings.

1,262,264. Electrodynamic Machine; Amato N. Sammarone, Akron, Ohio. App. filed Aug. 16, 1916. Improvement in the commutator support.

1,262,266. Motor Mechanism for Violin Players; Henry K. Sandell, Chicago, Ill. App. filed Dec. 19, 1914. Improvements.

1,262,270. Pocket Lamp for Firearms; Paul Schmidt and Carl Dobslaw, Berlin, Germany. App. filed April 23, 1914. Improvements.

1,262,276. Mold; Walter E. Skidmore, East Liverpool, Ohio. App. filed Aug. 8, 1917. Molded product is automatically released without breaking.

1,262,290. Regulator for Electric Motors; George H. Whittingham and William T. Holmes, Baltimore, Md. App. filed May 1, 1917. Electric motors used for driving individual machines.

1,262,307. Portable Electric Fuse Lighter; Albert S. Cole, Livermore, Cal. App. filed May 23, 1916. Improvements.

1,262,315. Telephone-Exchange System; Bert G. Dunham, Hawthorne, N. J. App. filed Oct. 5, 1915. For telephone-exchange systems utilizing automatic switches.

1,262,320. Porcelain Pull Socket; Edgar H. Freeman, Trenton, N. J. App. filed Nov. 8, 1915. No exterior metal parts.

1,262,323. Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed Oct. 29, 1917. Automatic line finders.

1,262,326. Automatic Interrupter for Electromagnetically Operated Pawl-and-Rachet Mechanism; Georg Grabe, Berlin, Germany. App. filed Feb. 15, 1916. Improvements.

1,262,330. Electric Switch; Monroe Guett, Hartford, Conn. App. filed Nov. 21, 1913. Improvements.

1,262,331. Electric Snap Switch; Monroe Guett, Hartford, Conn. App. filed Nov. 20, 1916. Improvements.

1,262,333. Indicating Device; John A. Hall, East Orange, N. J. App. filed Oct. 20, 1916. For use in telephone systems.

1,262,352. Calling Device; William Kaisling, Chicago, Ill. App. filed Nov. 19, 1915. Used in telephone substations for controlling automatic switches.

1,262,359. Impulse-Transmitting Device; John A. Kropp, Oak Park, Ill. App. filed Oct. 11, 1916. Relates to senders employed in automatic and semi-automatic telephone exchanges.

1,262,360. Sign; Frank O. Ladwig, Chicago, Ill. App. filed Feb. 10, 1917. Motor-operated changeable sign.

1,262,365. Automobile Signal; James P. McDermott, New Haven, Conn. App. filed May 4, 1917. Improvement.

1,262,378. Locking Device for Coil Boxes and Switches; Harry W. Neal, Indianapolis, Ind. App. filed Dec. 21, 1916. To control the electric circuits in automobiles.

1,262,382. Mail Box; Roy J. Oliver, Prescott, Ariz. App. filed Nov. 29, 1916. Signal given when mail has been deposited within the box.

1,262,391. Electric Rain Alarm; George A. Sabol, Clairton, Pa. App. filed Aug. 10, 1917. Improvements.

1,262,396. Arc Welding; John A. Seede, Niskayuna, N. Y. App. filed Jan. 9, 1914. Limits the current supplied to the work to a low value at striking.

1,262,411. Car-Lighting System; John F. Trittle, Schenectady, N. Y. App. filed Dec. 18, 1913. Improvements.

1,262,424. Electrical Switch; Albert C. Wynne, Birmingham, England. App. filed April 17, 1916. Key-operated oscillating-arm switch.

1,262,435. Electrically Controlled Lock; Gordon G. Berg, Chicago, Ill. App. filed April 6, 1916. Door lock may be positively latched to prevent its manual operation.

1,262,453. Process for Volatilizing Ores; Selden I. Clawson, Salt Lake City, Utah. App. filed Aug. 11, 1909. Apparatus in which the chorine gas may be reclaimed from the volatile chlorides and reused in the volatilization of the ores.

1,262,463. Fuse Plug; C. L. Dickson, Chattanooga, Tenn. App. filed July 8, 1916. Fuse-lock attachment which is to prevent the theft of energy.

1,262,487. Mechanical Locking Device for Press Controllers; George W. Harrold, Philadelphia, Pa. App. filed Jan. 27, 1916. Improvements.

1,262,490. Method of Apparatus for Translating Electrical Variations; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 30, 1907. Flow of electric current through a gas or vapor utilization.

1,262,491. Method of and Apparatus for Translating Electrical Variations; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 30, 1907. Improvements.

1,262,492. Apparatus for and Method of Translating Electrical Variations; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 30, 1907. Electrodes used in operative relation to a gas or vapor-carrying current.

1,262,496. Telephone-Exchange System; Edward E. Hinrichsen, East Orange, N. J. App. filed Aug. 2, 1916. Improvements.

1,262,497. Electrical System of Ship Propulsion; Henry M. Hobart, Schenectady, N. Y. App. filed Sept. 1, 1915. Improvements.

1,262,531. Ignition System for Explosion Engines; Henry A. Lyon, Solomon, Kan. App. filed Aug. 22, 1916. Improvements.

1,262,534. Ignition Mechanism for Internal-Combustion Engines; Samuel C. McKeown, Newark, N. J. App. filed June 21, 1916. Improvements.

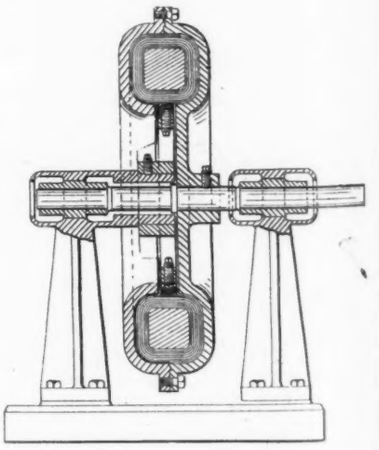
1,262,544. Ignition Device; William B. Moses, Brookline, Mass. App. filed March 10, 1916. Improvements.

1,262,558. Electrical Measuring Instrument; Willard E. Porter, Lynn, Mass. App. filed March 18, 1915. Improved adjusting means for the control spring.

1,262,581. Battery Construction; William Gardiner, Chicago, Ill. App. filed Feb. 7, 1916. Improved separator.

1,262,582. Protective Device; John F. Graybill, York, Pa. App. filed Oct. 5, 1914. For secondary circuits of electric distribution system.

1,262,585. Electric Motor; Edgar L. Hollingshead, Minneapolis, Minn. App. filed March 30, 1916. Rotor is free from winding, insulated bars or electrical fittings of any kind.



1,262,585—Electric Motor

1,262,587. Dynamo-Electric Machine; John W. Jepson, Depew, N. Y. App. filed May 8, 1913. For charging storage batteries and supplying lights on motor vehicles driven by gas engines.

1,262,599. Electric Motor; Thomas J. Murphy, Rochester, N. Y. App. filed Oct. 29, 1915. Used to produce a steady arc light of high candlepower for moving pictures.